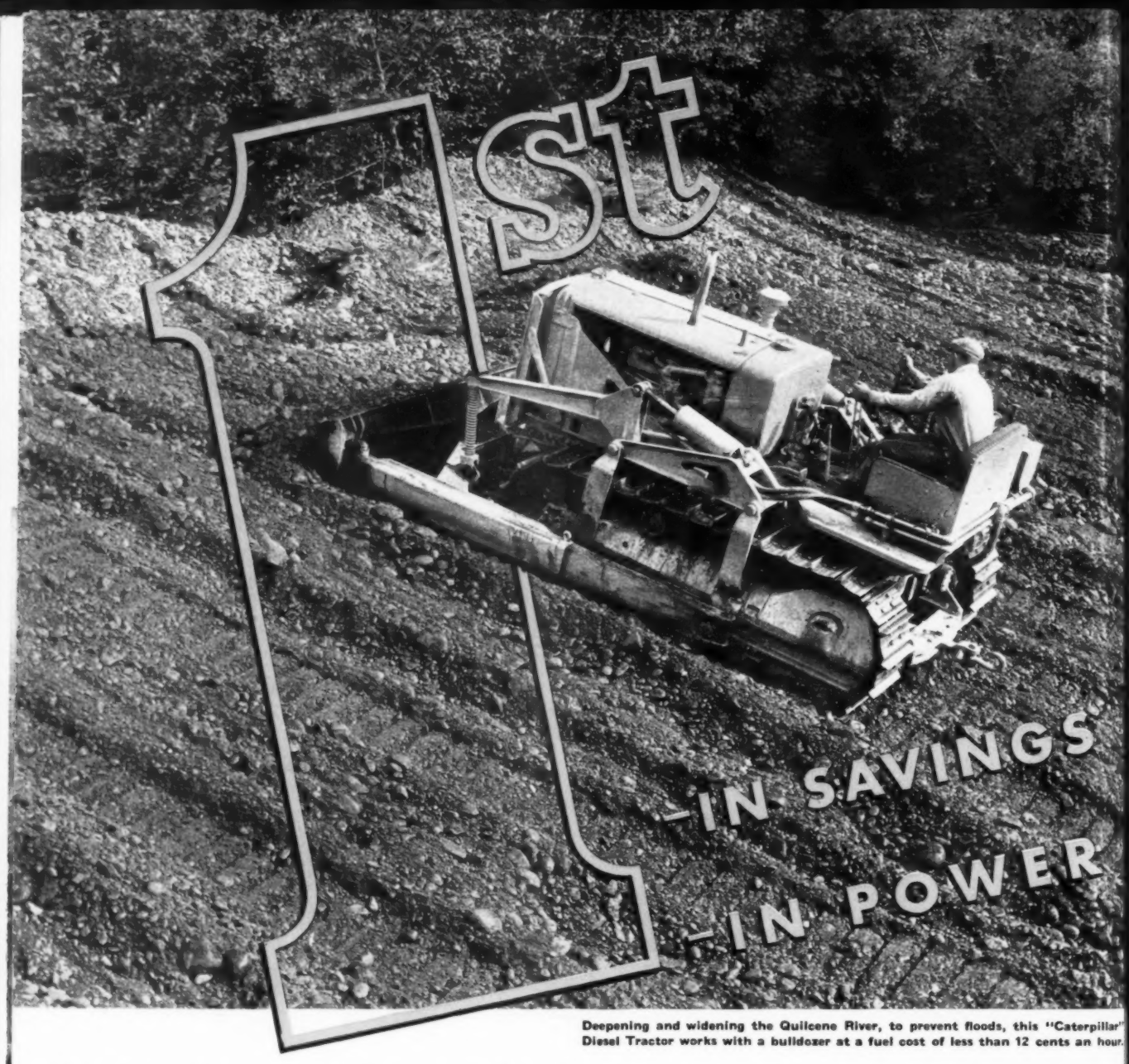
EXCAVATING ENGINEER

FOUNDED 1905

Vol. XXX MAY 1936 Number 5

TRANSPORTATION LIBRARY

From a completed section of tunnel on the Colorado River Aqueduct we see the entrance of a section under construction. Modern methods and equipment, made possible by the 92 miles of tunnel on the aqueduct, have resulted in approximately doubling the speed and halving the cost of tunnel construction. Turn to page 238 for the story.



Deepening and widening the Quilcene River, to prevent floods, this "Caterpillar" Diesel Tractor works with a bulldozer at a fuel cost of less than 12 cents an hour.

The difference between today's and yesterday's tractor power costs is the difference between the "Caterpillar" Diesel Tractor and the gasoline machine. Today, bids are made and contracts won on the savings that "Caterpillar" Diesel operation makes possible—fuel costs cut 60% to 80%, up-keep costs reduced to a record minimum. And the "Caterpillar" Diesel's versatile, heavy-duty engine—and its sure-traction, wear-resistant tracks—make another difference, raising work production, setting new figures for dependability and stamina. Get the whole story of the SHOW-DOWN from your dealer. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

THESE ARE SHOW-DOWN FACTS:

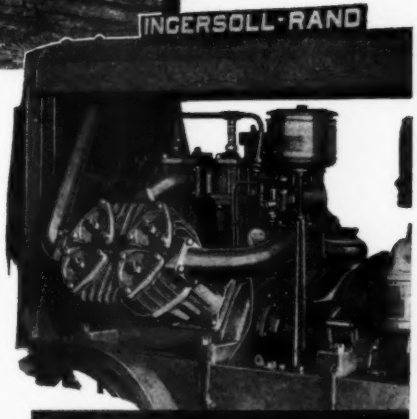
A contractor on the Florida Canal reports: "Our four 'Caterpillar' Diesel Tractors are moving 48,000 cu. yds. of sand per 6-day week. All are working 24 hours a day, averaging 83 yds. per hour per tractor on a 500-ft. loaded haul up a steep grade, climbing from 30-ft. cuts to dumps 15 or 20 ft. high."

"At an average fuel cost of only 14½ cents per hour," writes a Connecticut owner, "our 'Caterpillar' Diesel Tractor, equipped with bulldozer, has been handling 2500 cu. yds. of fill material per day."

CATERPILLAR DIESEL

REG. U. S. PAT. OFF.

Two-Stage Air-Cooled Portable Compressors



I-R was **first** to recognize the advantage of air-cooled construction for the compressor end of Two-Stage Portable Compressors.

All portables are in the last analysis air-cooled, even when the heat is carried away from both the compressor and the engine through the medium of water, for in reality the actual cooling of the water is accomplished by a draft of air created by the radiator fan.

The problem of cooling the engine is entirely different from that of cooling the compressor. The engine, to operate efficiently, should be kept at a temperature of about 180° F., which means hot water in the jacket. The compressor requires cool water to operate efficiently.

A compromise is made when both engine and compressor are water-cooled from one common system. With a common water cooling system, when the engine operates efficiently the water is too hot to properly cool the compressor, and if the compressor is correctly cooled, the water is too cold for efficient engine operation.

With the I-R Two-Stage Portable, water is used for cooling the engine and air for cooling the compressor, each of which performs its own duty correctly and represents the most efficient method for the purpose intended.

Vertical cooling fins on the I-R Compressor assist the cool air to rise to the top of cylinders. The intercooler fan draft quickly carries away the heated air, thus creating a more rapid heat exchange resulting in efficient cooling of cylinder walls and heads.

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In 1936 we celebrate our Centennial — and dedicate ourselves to the maintenance of these high standards, that Ensign-Bickford Safety Fuse may ever be dependable.

Upon request we shall send you, free, a copy of our new Centennial Booklet, giving a more detailed history of Safety Fuse. The booklet will be available about the middle of May.

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PUBLISHED MONTHLY
FOUNDED IN 1905

EXCAVATING ENGINEER

FOUNDED 1905

DEVOTED EXCLUSIVELY TO EXCAVATION

About Excavating Projects — By Excavating Men — For Excavating Men — The World Over

Vol. 30 **MAY, 1936** **No. 5**

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Looking Ahead

These interesting articles will appear in early issues of Excavating Engineer. Watch for them!

Building Fort Peck Dam
Dredging operations for the earth fill core, diversion tunnel construction, and the excavation for the spillway will be presented in a series of articles starting in an early issue.

The Aqueduct Moves Along
J. F. Shea Co. complete Schedule 20 and prepare to begin 27,564 foot cut and cover work on schedule 18.

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F. O. WYSE
Managing Editor

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Editor

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Advertising Manager

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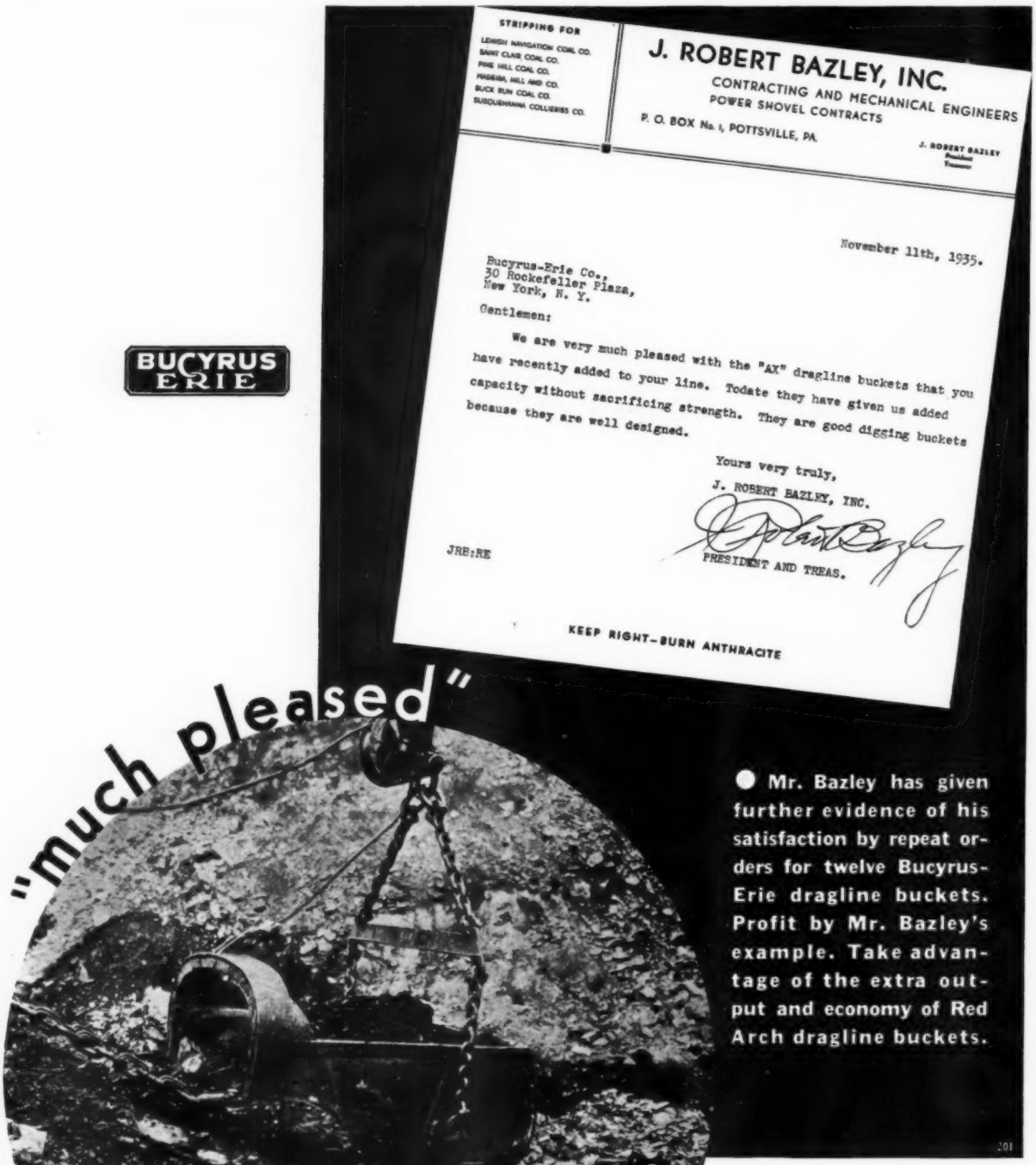
BUCYRUS ERIE

"much pleased"



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Treasurer

November 11th, 1935.

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New York, N. Y.

Gentlemen:

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Yours very truly,
J. ROBERT BAZLEY, INC.
J. Robert Bazley
PRESIDENT AND TREAS.

JRE:RE

KEEP RIGHT—BURN ANTHRACITE

● Mr. Bazley has given further evidence of his satisfaction by repeat orders for twelve Bucyrus-Erie dragline buckets. Profit by Mr. Bazley's example. Take advantage of the extra output and economy of Red Arch dragline buckets.

201

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UNITED STATES STEEL

For your convenience in writing to American Steel & Wire Company, you will find a card bound in this issue.

Not in the Contract

"Are you still bothered by those relatives of yours who come down from town to eat a big Sunday dinner, and never invite you in return?" asked Mrs. Smith.

"No," said the unfortunate victim, "They finally took the hint."

"What did you say to them?" asked Mrs. Smith eagerly.

"Nothing was said," explained the other, "but we served sponge cake every time they came."

A married couple were sleeping peacefully when the wife suddenly shouted out in her sleep: "Good Lord, my husband!"

The husband, waking suddenly, jumped out of the window.

A small boy leading a donkey passed by an army camp. A couple of soldiers wanted to have some fun with the lad.

"What are you holding on to your brother so tight for, sonny?" said one of them.

"So he won't join the army," the youngster replied without blinking an eye.

Father: "Why were you kissing my daughter in that dark corner last night?"

Flaming Youth: "Now that I've seen her in daylight I sort of wonder myself."

Contractor: "Here, hold my horse a minute, will you?"

Senator from Kentucky: "Sir, I am a member of Congress."

Contractor: "That's all right, I'll trust you."

"You look all-in today, Bill. What's the trouble?"

Bill: "Well, I didn't get home until after daylight, and I was just undressing, when my wife woke up and said: 'Aren't you getting up pretty early, Jim?' In order to save an argument, I put on my clothes and came down to the office."

A contractor of the old school took his daughter on a trip to New York. They went to one of those plays that made father blush a bit.

"I'm sorry, Dorothy, that I brought you here," he said. "This is hardly a play for a girl of your age."

"Oh, that's all right, Dad. It'll probably liven up a bit before the end."

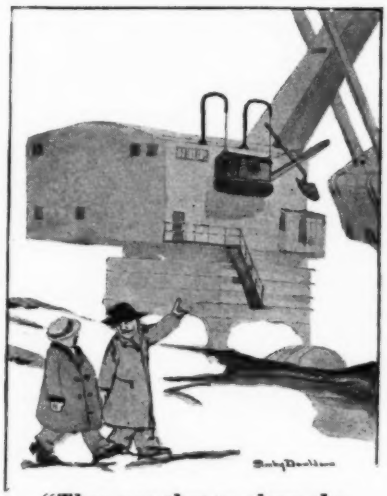
Jane—Do you think you are Santa Claus?

Jack—No, why?

Jane—Well, then, leave my stockings alone.

(Above joke dedicated to A.J.N., Chile)

After all, a man isn't any bigger than the things that make him mad.



"They use that to clean the dipper with."

Rastus' lawyer was informing him on the legal status of his matrimonial relationship and his chances for a divorce:

"Mistuh Johnson, I has discovered I can get you yo' divorce on the grounds that yo' marriage ain't legal on account of her father—he had no license to carry a gun."

"Sir, when you eat here you do not need to dust off the plate."

"Beg pardon. Force of habit merely. I'm an umpire."

Sign on a boathouse: "Trip around the lake—adults, 25c; children thrown in free."

Nigger Judge: "Are yo' guilty or not guilty?"

Prisoner: "Not guilty."

Nigger Judge: "Then, what are yo' doin' here wastin' my time?"

She: "Where did you learn to kiss like that?"

He: "I eat spaghetti."

Him: "Well, I suppose you're plenty angry because I came home with this black eye last night."

Her (sweetly): Not at all, dear. You may not remember it, but when you came home you didn't have that black eye."

Signs of Spring—

FIRST CHOICE for MAXIMUM DAILY YARDAGE

"NOTHING BEATS A FORGED-TRAK!"

If you've got to keep dirt MOVING . . . all day long . . . every day . . . put Athey Forged-Trak Bottom Dump Trailers on the job. Then you'll haul consistently, regardless of sticky or hard clay. And you'll haul bigger rounded loads, because Forged-Traks have the capacity and stamina to fit in with modern methods. Used either singly or in train, Athey Forged-Trak Bottom Dump Trailers roll on to profits and greater production. It pays to use them.

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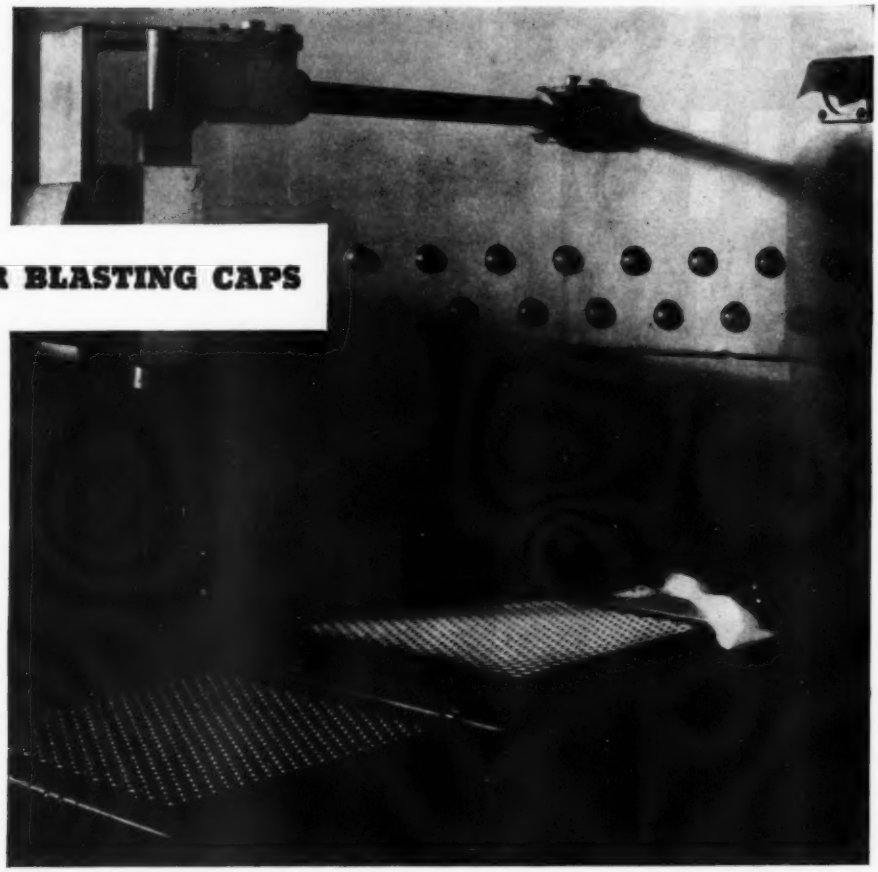

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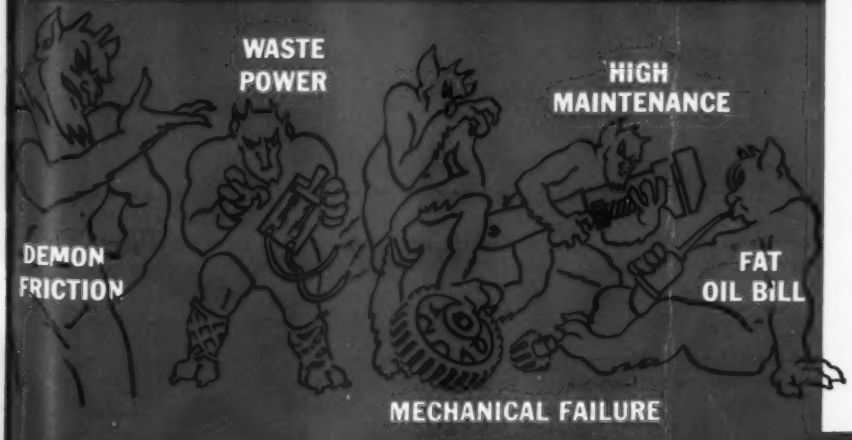
THEY'LL BE BACK AGAIN.. TOMORROW!"



Socony-Vacuum Correct Lubrication Keeps Demon Friction's Family of 4 off Your Payroll

WHY LET Demon Friction and his family of 4 come to work every time the whistle blows? They're costing you money! Even if you cannot keep them out of your plant, there's a scientific method by which you can easily curtail their costly mischief.

INTERESTING PROPOSITION ON THE NEXT PAGE

MAKE US TRY TO ELIMINATE REPAIR COSTS

Experience Gained on Thousands of Jobs backs up Socony-Vacuum Products

● You'd find it profitable to put us to work on your next job because we know an important part of your business—lubrication. Maybe we can't eliminate repairs for you, but we can minimize them. This, Socony-Vacuum has done for thousands of contractors.

We will supply the *right* lubricant for the job . . . work with your men . . . help them to find the places where Gargoyle Lubricants will safeguard your profits.

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A Wealth of Experience Back of INTERNATIONAL HARVESTER POWER

An International Harvester T-40 TracTracTor pulling an 8-ton concrete roller on top of the East Barre rolled-earth dam near Waterbury, Vt. This is one of the new flood-control dams being built across the Winooski river. Four TracTracTors were used on this dam.

●

The International Harvester line of industrial power (gasoline and Diesel) includes TracTracTors, wheel-type tractors, stationary power units from 12 h. p. to 100 h. p., and 1½ to 5 h. p. engines for light-duty service.

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See them about a demonstration.

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Two Pioneers

By CLARENCE EDWIN FLYNN

THE man who spliced two bits of wood,
And made himself a hoe,
And started digging on a hill
One morning long ago,
Returned one day in spirit form,
And watched the shovels swing
Upon an excavation job,
Amazed at everything.

HE hurried back and brought a friend
To look upon the scene.
And long they stood remembering
Crude ways that once had been.
The maker of the primal hoe
Upon a boulder sat,
And said: "See how they fling the dirt
Today—I started that!"

The photograph above shows a general view of M-W-A-K operations at Grand Coulee Dam — Courtesy Caterpillar Tractor Company.

EXCAVATING ENGINEER

MAY, 1936 VOLUME XXX NO. 5

• *Kumle & Ferris' 3½-B 1½ cubic yards of gold-bearing gravel into the hopper of the "doodle-bug." In the foreground may be seen tailings piled on ground already excavated.*

Digging Gold with Dragline and Doodlebug

Kumle & Ferris handle 1,250,000 cubic yards of gold-bearing gravel in 10 months, loading hopper on "doodlebug" with 1½ cu. yd. Bucyrus-Erie Dragline

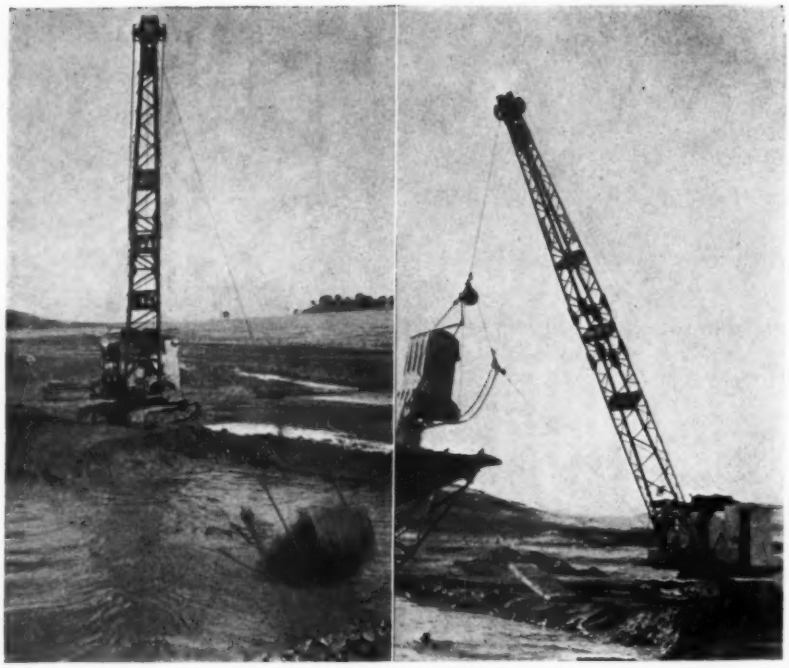
By **D. W. EVANS**

FOR MANY of our less able citizens the depression and the depreciation of the dollar meant a living "panning" gold. For more experienced mining men these circumstances were incentive to higher outputs of gold while the high values last. Among these experienced "gold-bugs" are Dan Kumle and Joe Ferris who have profited considerably during this past year from the method, new to California, which they have employed in extracting gold from more than 1,000,000 cubic yards of placer gravel near Valley Springs.

Few people realize that more gold has been extracted from California's earth and rock during each of these last lean years than during the height of the "Gold Rush" days of '49. Many operators similar to Kumle & Ferris, long experienced in the best methods of reclaiming gold, have contributed to the recent high annual output. Many, of course, have lost money mining gold because, as Mr. Kumle explains, "No one man during his own lifetime can learn all he needs to know to be a successful gold miner."

Roughly speaking, California's major gold values are found either in rock (and extracted by deep-mining and stamp mills) or in placer gravel (where passage of the gravel and sand over riffles leaves gold). Rock mining is more expensive and far more of a gamble, as a compensation for which, values are high, running into several dollars per ton of rock. Values in placer gravel run all the way from just "color" to as high as $2.00 or more per cubic yard. The gold available can readily be determined by test holes over the valley of some still flowing or prehistoric river course. This costs money, of course, and it also costs money to lift the gravel in these valleys and wash it over riffles. Lower costs in handling naturally make profitable the exploiting of deposits of placer gravel, long

• *A vitally important part of placer mining operations is rebuilding the dragline buckets every two days so they can dig properly. Note the special lip, designed to excavate cleanly to bed rock.*



• *Left: Operating at high speed 24 hours per day, the Bucyrus-Erie 3½-B dragline, operated at this time by Henry Newell, drops its 1½ yard bucket into the pond for another bite. Right: Here goes another bucket-full into the hopper. This process has been repeated about 2500 times per day, each day for 10 months.*

known to bear gold to a definite value per cubic yard.

Gold dredges limited in use by depth of gravel

Cheapest method of extracting gold from placer gravel was found, more than a generation ago, to be the gold dredge or placer dredge which could, at a profit, dig, wash and discharge gravel bearing recoverable gold as little as 6c per cubic yard. Chief drawback to this method, which is still employed in annual recovery of millions of dollars' worth of gold from California's placer deposits, is that the gravel excavated had to run at least 12 to 15 feet in depth to provide flotation for the dredge. Thus thousands of acres of placer gravel deposits known to contain gold in paying quantities were unworkable because no known method existed of extracting the gold profitably.

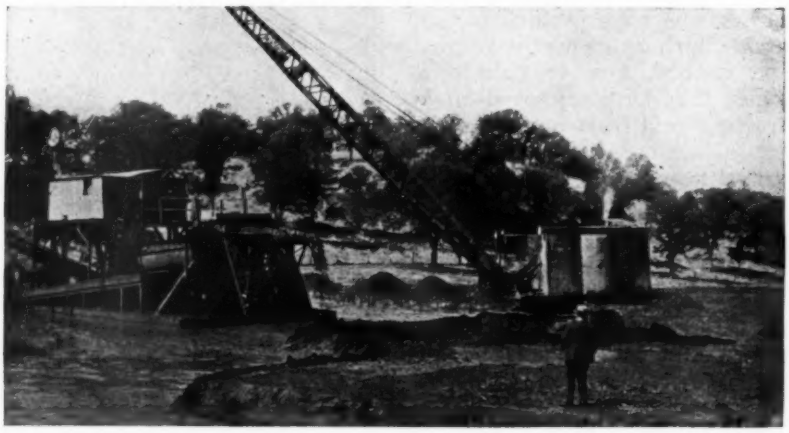
The "doodlebug" opens many placer deposits

A means of working just such properties has been employed by Kumle and Ferris in their recently completed operation near Valley Springs, the method being indicated in the title of this article. By removing the digging machinery from a placer dredge, flotation depth has been reduced to 30 inches, with receiving hopper, pumps, riffles and belt for discharging tailings still retained aboard. This "decapitated" dredge is known as the "doodlebug." The excavation on this particular job is handled by a Bucyrus-Erie 34-B Diesel dragline with 1½ cu. yd. bucket.

For Kumle & Ferris the venture at Valley Springs has been profitable, the amount of profit made on the rapid handling of 1,250,000 yards of placer gravel being entirely their own business. Long experienced in this particular line, they have a far larger and more elaborate placer mine at John Day, Oregon, latest in a series of placer excavation projects extending back over 20 years.

The property worked at Valley Springs averaged 9 feet in depth to bedrock, was roughly 200 yards in width, running down the course of a small creek for a distance of a little over a mile. First step after setting up equipment and a repair shop was a small dam across the creek to provide reserve water for flotation and washing. The "doodle bug" built on the site, was 20 feet wide by 30 feet long, with a conveyor belt projecting from the "stern" about 20 feet. The business end of the machine had a hopper of 5 cu. yd. capacity, with grizzly bars over its top, capable of receiving the discharge from the dragline. A slightly sloping, revolving screen with ⅜" diameter holes extended the length of the dredge, carrying to the conveyor at its discharge all material larger than pea gravel. Powerful streams of water playing on the receiving hopper and the screen washed boulders clean, broke up lumps of cemented gravel. Material passing

• *Jets of water under high pressure break up lumps of clay and cemented gravel as they strike the hopper. A muddy stream may be seen spilling over the edge of the hopper, but the gold, being heavy, has already passed through.*



• *High yardage outputs are obtained by increasing line speed on the dragline to 220 feet per minute. Output in this case justified increased maintenance costs due to the extra speed.*

through the screen flowed over two parallel lines of riffles periodically cleaned, which caught the fine gold.

All recoverable gold very small in size

You may wonder, as this writer did, whether sizable nuggets of gold might not pass along the revolving screen, find their way back along the discharge conveyor to the pile of tailings. We're still worried about this, but Mr. Kumle endeavored to reassure us by pointing out that nuggets do not occur unless there are many smaller lumps of gold, and in 8 months of operation he had encountered no grains of gold larger than a grain of sand.

Operation 100% Diesel Powered

Power for operating the rotary screen and for pumping the water at high pressure is supplied by a 60 H. P. Atlas Diesel engine mounted on one rear corner of the barge. The pump is directly connected to the engine, which drives the screen through simple gearing.

The Bucyrus-Erie dragline is likewise powered by an Atlas Diesel engine, of 80 H. P. To obtain high outputs the engine speed was stepped up 35% giving 220 feet per minute line speed to the drag cable instead of 160 feet per minute which is standard. This large increase in speed has naturally increased maintenance costs on the dragline, but the phenomenal outputs of yardage obtained are considered more than satisfactory compensation.

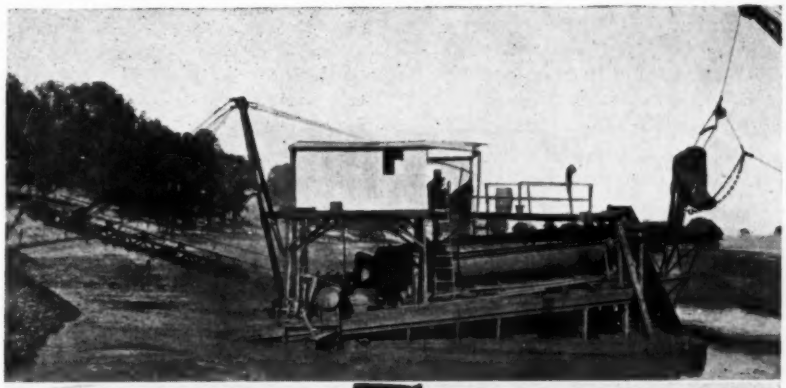
Dragline excavates 3800 yards per day

Dredging operations were carried on virtually 24 hours per day and 7 days per week with only enough time taken out to insure proper servicing of the dragline and the washing plant. This delay averaged 1½ hours per day. On the basis of output figures already given, the yardage handled amounted to 182 cubic yards per hour throughout 10 continuous months of operation. Whether or not this establishes a record of outputs for 1½ cubic yard dragline, it is certainly an impressive output figure, especially as practically all of the excavation was under water.

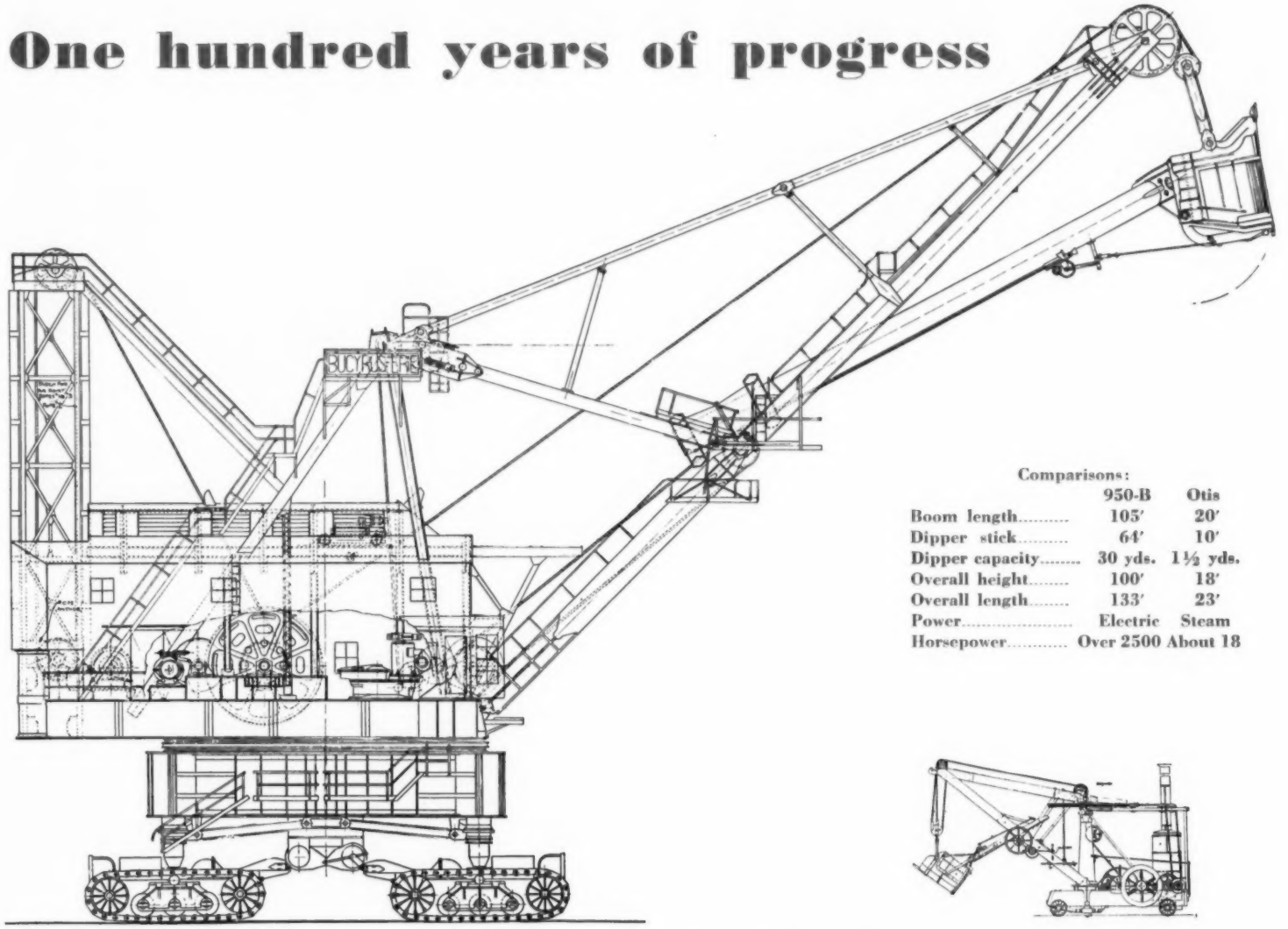
The method of operating this excavating job was simple. The washing plant of course was floating, anchored to the banks of the pond by four cables, and moved by winches located on the barge. The dragline was at all times on ground, and as it moved the barge was moved so that the receiving hopper was always located conveniently. Working back and forth across the narrow valley, this team moved gradually downstream, the dragline taking about a 35 foot cut at a time.

(Continued on page 258)

• *Top: The washing plant. The large revolving screen is operated by a 60 H.P. Atlas Diesel Engine, mounted near the stern, (to the left) and also driving a centrifugal pump for washing water. Bottom: The chutes containing the riffles discharge directly into the pond, while an adjustable belt conveyor carries the heavier particles from the screen up to the tailings pile.*



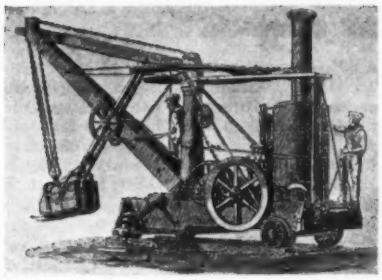
One hundred years of progress



Comparisons:	950-B	Otis
Boom length	105′	20′
Dipper stick	64′	10′
Dipper capacity	30 yds.	1½ yds.
Overall height	100′	18′
Overall length	133′	23′
Power	Electric	Steam
Horsepower	Over 2500	About 18

1936 **1836**

Comparative drawings to the same scale of the present day Bucyrus-Erie 950-B coal stripper and the Otis shovel of 1836. Figures for overall length and height are taken with booms in the positions indicated in the drawings.



Digging by "Stame"

This installment deals with the men who used the early steam shovels, and the jobs on which they were used

By **WILLIAM ELLISTON FARRELL**

(Copyright, 1936, by William Elliston Farrell)

This is the second installment of the first complete and authentic history of the early steam shovel. It first appeared in the April Excavating Engineer. If you missed your copy, write for it.

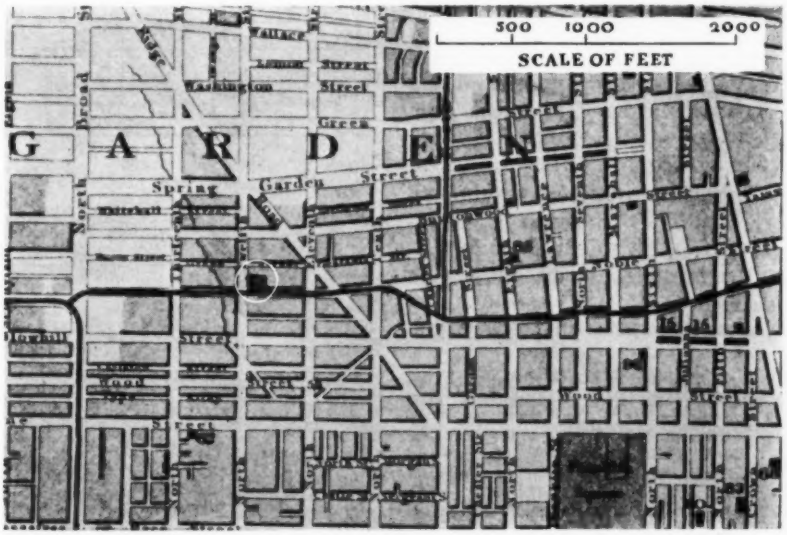
AFTER the death of Wm. S. Otis and the completion of the seven Philadelphia shovels, about twenty years elapsed before any more power shovels were built. It is possible, however, to trace the activities of the existing machines in this country and abroad.

Before doing so, however, it is interesting to draw attention to correspondence which throws some light on the men of the day, and their business relationships. Published in the Philadelphia Courier and Enquirer of February 25, 1837, this correspondence contains one of the earliest—if not the first—public printed references to the name of Wm. S. Otis.

Guardian of the Contractor's Interest

"In giving place to the following correspondence between Major McNeil and the contractors who under him constructed the Boston and Providence Railroad—a work which probably has no rival in all that pertains to its durability—we deem it unnecessary to say ought in regard to the merits of Major McNeil as an engineer. His reputation is too well established in the estimation of the public to require any such testimony from us; but we deem it a duty alike to him and to contractors generally, to call public attention to the fact elicited by this correspondence, that the engineer considered himself not only the representative and agent of the Company, but so far the guardian of the interests of the contractors, as to feel it is his duty to make them a liberal allowance for obstructions in excavations which no ordinary foresight and prudence on their part, could enable them to anticipate. Thus, where contracts were taken in good faith, and it was subsequently discovered that unanticipated obstructions occurred which would render their contracts exceedingly onerous, the Engineer allowed them, under the sanction of a very liberal board of direction, such additional compensation as justice and liberality dictated, without reference to the mere letter of their contracts.

"Such conduct merited a proper expression of feeling on the part of the Contractors, while the constant aim of the Chief Engineer to add character to the business, entitled him to their respect and esteem. We hope the



• The shop of Eastwick and Harrison was located at the corner of North Twelfth and Noble streets as indicated in the circle on this section of an 1841 map of Philadelphia.

Charles Howe French

CHARLES HOWE FRENCH was born at Canton, Massachusetts, in 1814. He was left an orphan at a very early age and when only sixteen was apprenticed to a millwright. There it little doubt that Otis made the acquaintance of French, or certainly became intimately acquainted with him, because they were frequent visitors at the home of Leonard Everett in Canton, and shortly after Otis' marriage to Elizabeth Everett, French married her sister Almira.

French continued his association with the firm of Carmichael, Fairbanks and Otis until it was broken up by the death of Otis and the departure of Fairbanks for Russia. Later it was reported that Carmichael took French into partnership with him when he secured a contract for widening a portion of the Welland Canal and that although Carmichael returned to the States within a year, French continued for five years in Canada until the work was completed. Authority for the statement has not been found, but it is reported that on this contract French used an Otis shovel. This was probably the work done in the year 1850 between Welland and Port Colborne although as early as 1841 the legislature of upper Canada decided to enlarge the canal. As this work was in the nature of dredging and as the two shovels built in Philadelphia were probably in continuous operation in the States, it is probable if an Otis shovel was used on the Welland Canal it was the original shovel built in Canton.

French returned to Canton after completing the work in Canada and engaged in a number of industrial adventures, in one of which he was a partner of O. S. Chapman.

lesson inculcated by this correspondence, will not be lost upon other Engineers, and the board of Directors under whom they act." (Ed. Cour. & Enqr.)

To Major Wm. Gibbs McNeill—

Sir,—At a meeting, holden at the Astor House, in the City of New York, on Wednesday, Sept. 28th, 1836, Thomas Hassard, Esq., being called to the Chair, and Jonathan Crane appointed Secretary, it was voted unanimously that

Whereas, the undersigned, having been Contractors and Agents on the Boston Providence Railroad, of which you, sir, were the Chief Engineer and Agent, feel it a duty to make an expression of their high consideration and respect, not merely for the judgment and skill you have displayed in the location and construction of said road, but more especially for your liberal policy, your kind and affable treatment to those who have executed contracts under your agency:

Therefore, resolved unanimously, That Thos. Hassard, E. Turner, and D. Carmichael, be a committee to present you, sir, a pair of silver pitchers and a vase, which we respectfully request you to accept, as a small memento of our mutual regard.

Most respectfully yours,

Thos. Hassard	*Thos. Bell*
Jonathan Crane	*Levi Walton*
W. J. Duval	*Wm. McDermitt*
John Borland	*Joseph Sturgess*
William Otis	*E. Turner*
Stephen Otis	*E. D. Turner*
Aaron Carso	*A. C. Vedder*
R. G. Fairbanks	*J. P. Vedder*
Daniel Carmichael	*Michel Onil*
Wm. S. Otis	*Joseph Mankin*
James Muranus	*Janus Mankin*
Daniel B. Carson	*John Moss*
Wm. A. Bird	*Alex'r. Birnie*
John T. Clarke	*John L. Bevens*
Ira Doder	*K. Beckwith*
Jacob Stearn	*N. D. Williams*

— Riley

To Major Wm. Gibbs McNeill—

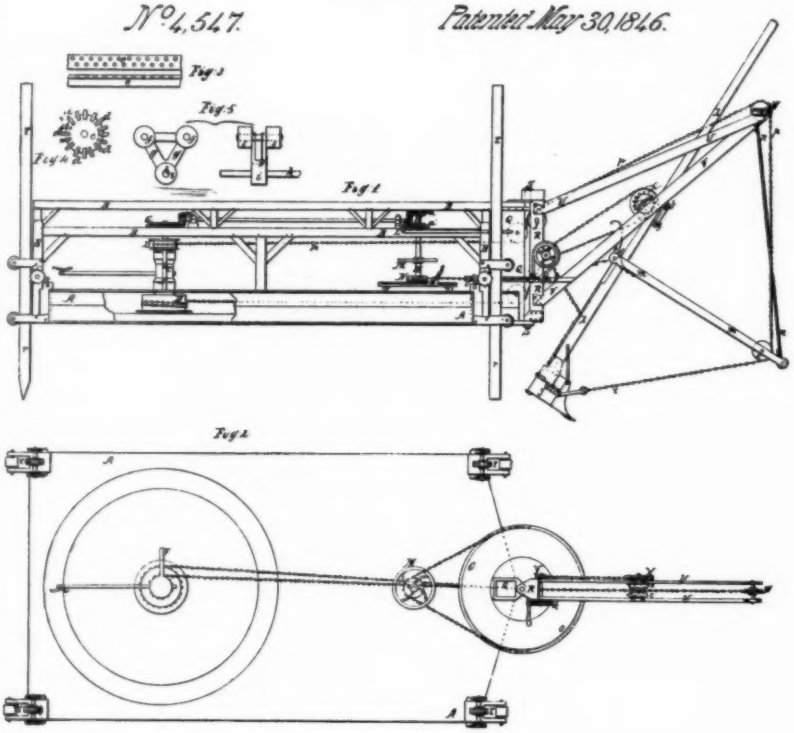
Sir,—The Contractors who have been engaged on the Boston and Providence Railroad, lately finished, under your superintendence, desirous of attesting their appreciation of your character and conduct, have appointed Messrs. E. Turner, D. Carmichael, and myself, a committee to procure and present to you, the accompanying pieces of plate.

In the unavoidable absence of my colleagues, the performance of this pleasing duty devolves upon me. Having been for a longer period than any of my associates connected with works of which

Carmichael & Osgood.

Dredger.

No 4,547. *Patented May 30, 1846.*



* *In 1842, J. C. Osgood, of Troy, N. Y., met Carmichael and saw probably for the first time—an Otis shovel. They conceived the idea of a dredge with boom and dipper similar to those on the Otis shovel. Due to difficulty of securing fuel, two horses were to furnish the power.*

you were the Chief Engineer, it gives me peculiar pleasure that I am selected to present you this evidence that the kindness, courtesy and candor which has always marked your conduct towards us, has been duly appreciated.

In behalf of my associates, as such evidence, I ask your acceptance of a Silver Vase and a pair of Pitchers, herewith presented.

With great respect,

Your obedient servant,

Thos. Hassard

New York, January 1, 1837

To Mr. Thomas Hassard—

Sir,—I beg to return to the Contractors of the Boston and Providence Railroad, represented by the Committee of which you are the Chairman, my most sincere thanks, not only for the splendid plate which they have done me the honor to present to me, but for the warm expressions of their personal regards which, in their names, you have so kindly tendered me.

Such an evidence of their good feeling towards me is indeed amongst the most gratifying rewards, which have attended my heart, the friendship and affection which you assure me I have won at the hands of those represented by yourself. From an intimate intercourse for years past, I respect and esteem them personally, as I trust, it has been uniformly apparent, I do their calling, I look upon them as identified with the Boston and Providence Railroad; and if, in its conception, general plan and location, there be anything to merit the approval of the public—in its substantial and permanent construction, indeed in the faithful execution of their trust, there is, in my opinion, infinitely more to command the gratitude alike of the stockholders and the engineer.

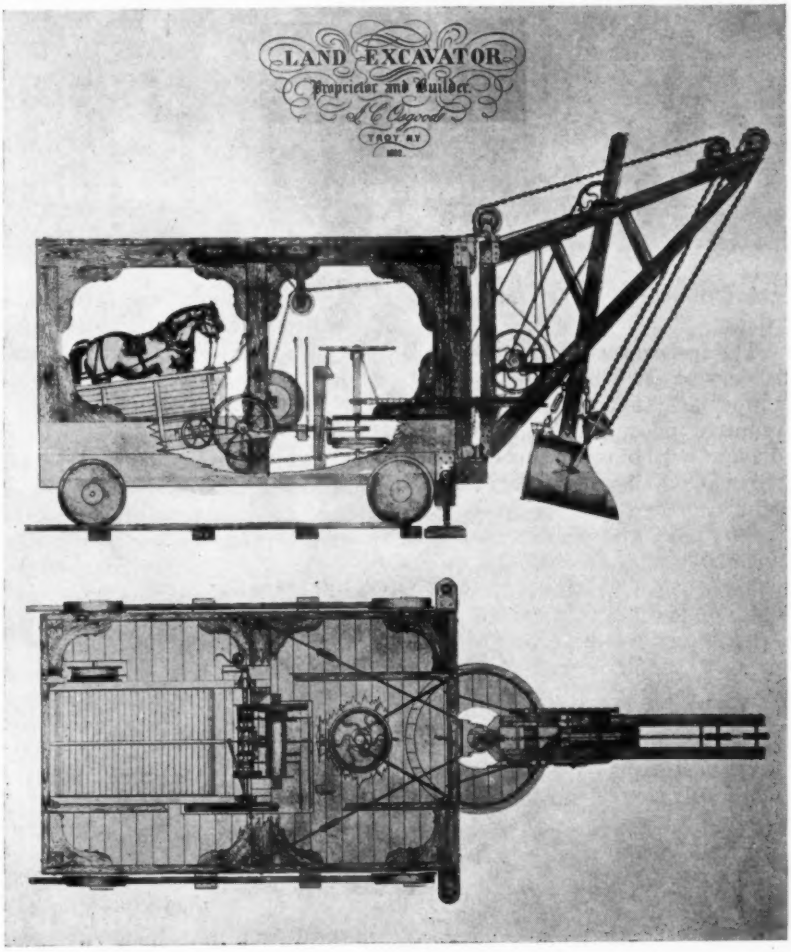
That intelligent, upright and experienced Contractors should be preferred, and while they maintain, (as those of the Boston and Providence Railroad have done, without, I believe, one single exception) the deserved character of being such, should be sustained and encouraged by the Engineer, is too obviously proper to admit of question. For I regard them as fellow laborers in a common cause, and agents, in fact, with him, of the Corporation; and when their best energies shall, to his knowledge, have been given to the promotion of the interests of their employers, surely a just appreciation of the labors of the contractor—a consideration of circumstances, concealed from the eye of man, and unanticipated, till disclosed by those labors, but which nevertheless, if overlooked, would deprive him of an adequate return, if not involve him and those dependent on him in ruin—surely, I say, such a course, on the part of the engineer, cannot be at variance

(Continued on page 260)

Daniel Carmichael

HERE is little record of the early life of Daniel Carmichael other than the fact that when Otis was a very young boy and his family were living at Otisville, New York, the Carmichael family lived only a few miles away at Mamakating. In 1820 Daniel Carmichael married Almira Otis, an aunt of Wm. S. Otis. She died in 1831, and Carmichael married her niece, Eliza Otis, in 1832. He was the senior member of the firm of Carmichael and Fairbanks, which later became Carmichael, Fairbanks and Otis. This firm was evidently one with a reputation for good and efficient work.

From 1835 to 1846 the record of Carmichael is clearly traced through the use of the steam shovel. After the completion, however, of the Atlantic Docks in Brooklyn in 1846, when Carmichael's partner was James Stranahan, no information seems available. It is known that he had a son, Henry Carmichael, who graduated at Amherst, studied abroad and later became a distinguished consulting and manufacturing chemist, who last lived at Malden, Massachusetts, where he died in 1924.



• *This drawing, made in 1852, shows application to a land excavator of a machine similar to that patented in 1846 by Carmichael and Osgood.*

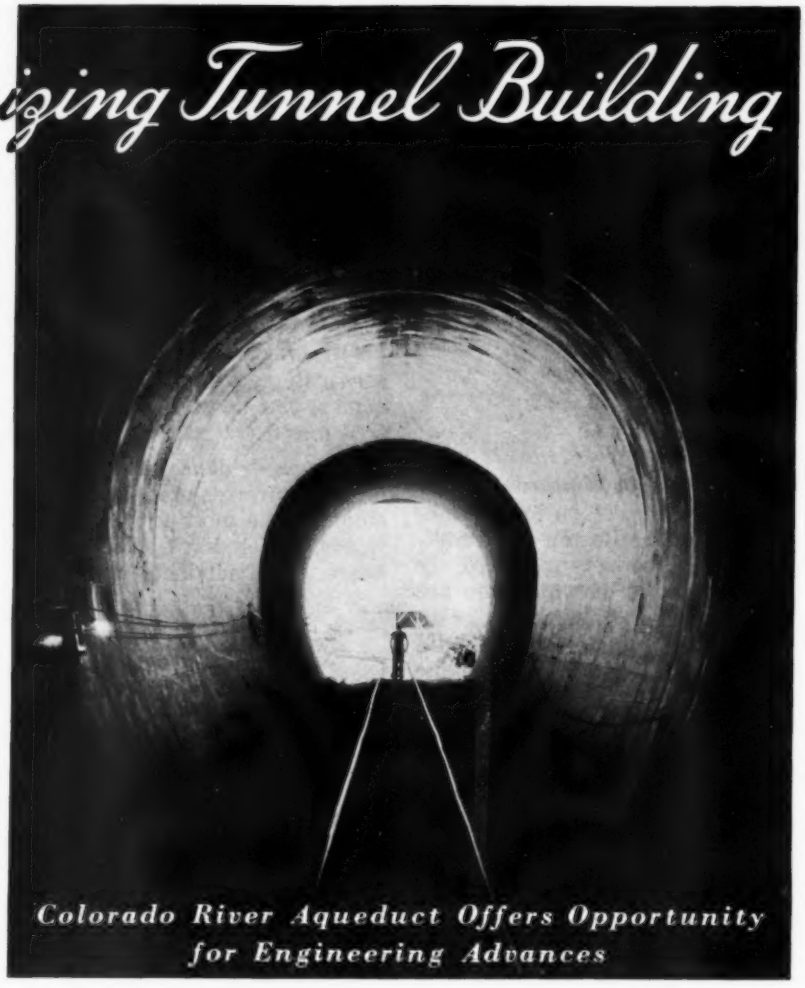
Revolutionizing Tunnel Building

By **JOHN R. MARCY**

CHIEFLY because of modern equipment, man can today rend his way through mountains and under cities with close to twice the speed and at half the expense that has ever before been possible.

This revolutionary development has been brought about on the Colorado River Aqueduct, whose 92 miles of tunnels have presented problems giving scope for the fullest achievements of modern engineering.

Here, in some cases, tunnels have been constructed as cheaply as the concrete conduit that is used in open country. Aqueduct tunnels have averaged around $600,000 per mile. A comparison with the cost of other tunnels will show the enormous difference. The Edison Florence Lake tunnel, for instance, built in 1922, is 13 miles long, and cost $16,000,000. The Shandaken tunnel that carries the water supply of New York City, built in 1923, is 18 miles long and cost $12,000,000, but it is only 10 feet 3 inches in diameter against the Aqueduct's 16 feet 4 inches. The Moffett tunnel in Colorado, only 6 miles long, cost $14,000,000. Here, however, great difficulties were encountered.



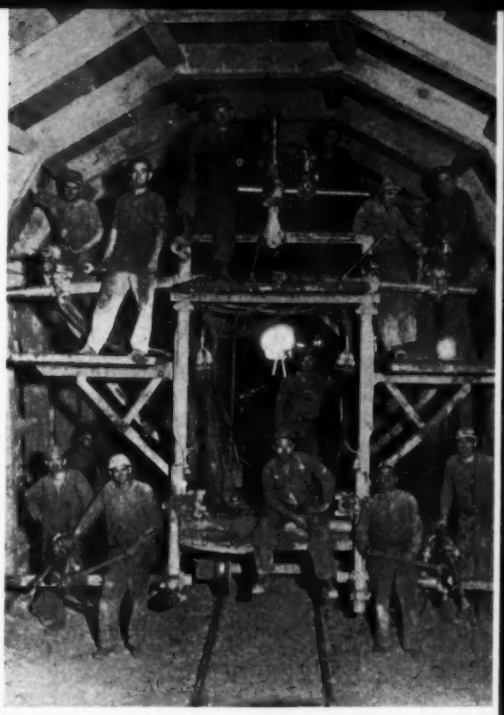
Colorado River Aqueduct Offers Opportunity for Engineering Advances

The importance of these figures is very great. The advantages of tunnel are that it is permanent, requires no upkeep, and can be driven without disturbing the surface, which latter is an important consideration in cities. In many cases where tunnel was desirable, cost has hitherto ruled out its use. Our future progress will undoubtedly demand even greater underground engineering projects than the past—subways, water systems, railway terminals, perhaps even highways — and if these are to be carried out, still further advances in engineering methods must be made.

* *All seams are smoothed out with air grinders. Every effort is made to get tunnel interiors perfectly smooth so as to obtain minimum resistance to water flow.*

A great many improvements have been made in equipment and methods, but those chiefly responsible for the latest advance in engineering are those in drilling, mucking, and haulage.

Today a great drill carriage, running on steel tracks, and mounting a battery of from 4 to 6 drills, advances to the face of the tunnel. Each drill weighs around 275 pounds, and is entirely automatic, even to oiling. An operator connects the air and water lines and then sits back and smokes a cigarette while the powerful drills batter their pattern of holes into the rock. When they are "up to the hilt" they are automatically withdrawn and longer lengths of steel substituted until the holes are as much as 14 feet deep. Each drill makes several holes, honeycombing the face of the tunnel. These holes



• *Modern speed calls for drilling several holes simultaneously. This carriage mounts five drills—three above and two below— and is ready to advance to the face of the bore.*

are then loaded and shot, the whole round of drilling and shooting taking perhaps as little as 2½ hours.

Formerly drills were clamped on upright steel columns, and each drill had to be carried forward and seated on the column by the operator. A big man could do it alone. The drill was fed forward with a hand crank, and was pulled back by hand. Only the top half of the tunnel was usually shot, leaving what was called a bench below. After the shot, the muckers removed the rock while the men were drilling new holes above. The muck, or blasted rock, was loaded into cars, often by hand, and when one was full it had to be switched back, maybe for a long distance, so that another could take its place.

Today the whole face is shot. Then, instead of the long and laborious process of hand shoveling, a swift machine scoops up the muck, loading a car in perhaps one scoop that formerly would have taken fifteen to twenty minutes to load by hand. Improved switches than can be moved along in the tunnel as it advances facilitate the handling of the loaded cars and speed up the progress.

While some of the aqueduct tunnels are equipped with trolleys, most of them use storage battery roller bearing locomotives. This eliminates the slow business of installing trolley wires, which are also dangerous live wires. So quickly is this whole work effected that in three shifts, the usual number in one day, five or six complete rounds of drilling, mucking, and shooting may be completed. This means speed, and speed means economy. In one tunnel, for example, a shift average of one foot per man was maintained. That is, if there were ten men on an eight hour shift, they would drive ten feet of tunnel in that time. Records such as 63 feet for 47 men are not uncommon — and that, when it is considered that much of the tunnel has to be timbered for support, is something.

After the tunnel is made, it is lined with concrete and all seams made smooth with air grinders. This greatly facilitates the flow of water, for any friction, even that caused by a rough surface, appreciably slows down the flow of water and so decreases the capacity. The concrete is put on by big pumpcrete machines, which pump the soft mixture into place with a speed which a few years ago would have been considered magical.

The whole thing is on a gigantic scale — the structure, the labor, the machines. Electricity is for the most part the young giant behind the muckers, drills and cars. When the great aqueduct is finished enough concrete will have been poured to construct a 14 foot highway from New York to Los Angeles; the earth that will be excavated would cover a city block to the height of a mile; 41 million pounds of explosive will have been used; and steel, copper, timber, aluminum, in proportion. The aqueduct will carry to those cities of Southern California comprising the Metropolitan Water District one billion gallons of water per day. Man's former efforts of similar nature are dwarfed in comparison.

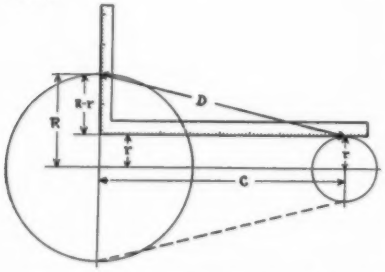
• *Left: Storage battery, roller-bearing locomotives have replaced the old trolleys, eliminating time and danger involved in use of trolley wires. Right: Minutes mean money—save one and you save the other. Modern tunnel shovels have proved this by the speed with which they've mucked out on the aqueduct.*

Field Notes

Useful Steel Square Kink for Finding Length of Belt

HERE is a quick and sure method for finding the length of any open belt. It is more accurate than most of the rules ordinarily used for computing belt length.

Along one edge of the steel square lay off the distance C which is the distance between shaft centers. For convenience, you may let one inch on the steel square be the equivalent of one foot.



Then along the other edge of the square lay off the distance (R — r) as shown in the sketch. This is the "difference in the radii of the two pulleys." Let one inch on the scale equal one foot as before.

Then measure the distance D between those two points which you have located. As is obvious in the sketch the distance D is equal to one of the diagonal lengths of the belt. The other diagonal is indicated by the dotted line on the other side of the pulleys.

The distance D is easily measured by the same steel square by marking the located points on a flat surface, or by means of a ruler or tape or any other convenient method.

Now to find the total length of the belt we must merely multiply the distance D by 2 and then add one-half the circumference of the large pulley and one-half the circumference of the small pulley. The sketch shows clearly why this is true.

Or, putting it in the form of a rule, add the radius R of the large pulley to the radius r of the small pulley and multiply the sum by 3.1416. To this add twice the distance D. The result is the length of the belt.

In view of the fact that steel squares are usually graduated in sixteenths or eighths of an inch, the following table will be found handy when one uses the scale, 1 in. = 1 ft. Thus:

1″= 1.3 sixteenths on the square
2″= 2.7 sixteenths on the square
3″= ¼ inch on the square
4″= 5.3 sixteenths on the square
5″= 6.7 sixteenths on the square
6″= ½ inch on the square
7″= 9.3 sixteenths on the square
8″=10.6 sixteenths on the square
9″=¾ inch on the square
10″=13.3 sixteenths on the square
11″=14.7 sixteenths on the square
12″=16.0 sixteenths on the square

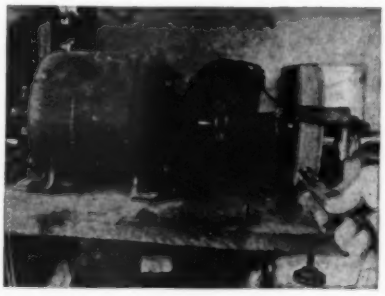
For example, if it is found that the distance D is 20 inches and 13.3 sixteenths on the steel square, the belt length represented by D is 20 ft. 10 inches.

Of course when making these computations it is not necessary to draw a sketch. This one is given merely to make every step clear and to show why this method works out with such certainty. All that is necessary is to know the radii of the two pulleys and the distance between shaft centers. Then the steel square and the rule given above will do the rest. What the steel square really does is—it eliminates the necessity of extracting the square root for making accurate belt length computations. Extracting roots is an irksome operation which most of us heartily dislike.

—W. F. Schaphorst, M.E.

Simple Drive Shaft for Motor

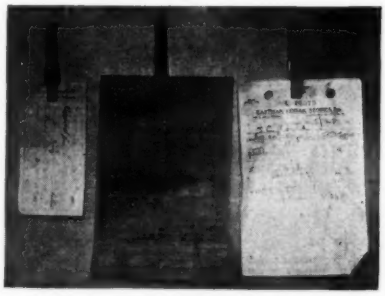
IN A SMALL workshop, where equipment is scant, an electric motor may be attached to the shaft of grinder or other small machine by using a short section of garden hose, with a clamp tightened on each end by means of a stove bolt. A distinct advantage of this is in the ease with which the hose may be removed and the motor attached to a different piece of equipment, such as a generator, shown also in the photo.



—Joseph C. Coyle.

Paper Clips from Clothes Pins

IN THE temporary office, or field shack, simple holders for papers may be improvised from wooden, spring clothes pins. The pins are simply glued or tacked to the wall, taking care not to split the wood if tacks are used.



Altitude Influences Pump Suction

IT IS a well known fact that the pressure due to the atmosphere decreases with increasing height above sea level. As the ability of a pump to lift water is entirely due to the pressure of the atmosphere, the distance above the water level at which the pump is located will be limited by the atmospheric pressure. From the accompanying table it may be seen how the theoretical lift of the pump decreases as more altitude is gained. At sea level the theoretical lift is 34 feet while at an elevation of 10,000 feet the lift would be approximately 26 feet, a total variation of 8 feet. Naturally the actual lift of a pump say of the centrifugal type would be less than the theoretical lift. The pump must not only overcome the actual vertical lift of the water but must also overcome friction and losses due to the velocity of the water. Prob-

ably the highest practical suction lift would be about 6 feet less than the theoretical and then only with ideal operating conditions with no leaks or air included in the water. The water temperature would have to be down around the freezing point too. It is only with specially designed pumps and ideal conditions that the possible lift could be obtained. It has been recommended by some that at sea level the lift should not exceed 25 feet and 16 feet at a mile elevation. The better policy is to keep the suction as short and direct as it is possible in all cases.

Table Accompanying "Altitude Influences Pump Suction"

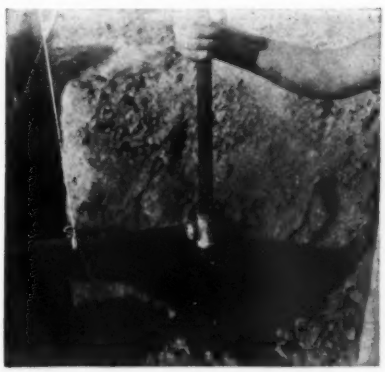
City	Average Alt. above sea level	Approx. Theoretical Lift.
New Orleans, La.	6.5 ft.	34 ft.
New York, City, N. Y.	124.0	33.8
Chicago, Ill.	597.0	33.5
Madison, Wis.	886.0	33.0
Atlanta, Ga.	1076.0	32.8
Ellsworth, Kan.	1539.0	32.0
Salt Lake City, Utah	4336.0	29.0
Denver, Colo.	5373.0	27.5
Colorado Springs, Colo.	6039.0	27.0
Grand Canyon, Wy.	7826.0	25.0

K. B. Humphrey.

Adjustment for Metal Guard Railings

TEE CONNECTIONS, brazed to the ends of metal railings, used about excavations, etc., make it easy to adjust the height of the railings, as well as to assemble or move them. The upright metal stakes are also made of pipe, with a sharpened section of rod at the bottom end. They are inserted through the tee joints in setting up the railings, and secured by tightening a set screw in a nut welded to the tee. A metal cap on the top of the stakes prevents battering in driving them down.

—Joseph C. Coyle.



When You Fall

1. **Keep your hands free to grip the rails when climbing or descending stairs or ladders.**
2. **Take short paces in slippery places.**
3. **Wear good shoes.**
4. **If you are timid about climbing to high places —better stay on the ground.**
5. **Protect yourself with substantial railings when working on scaffolds and similar structures.**
6. **Use a safety belt and line when working in places where no form of protection is available.**
7. **Don't pass up a stumbling block—remove it.**
8. **Look out for untied shoe laces and baggy trouser cuffs.**
9. **Face in the direction of travel when stepping off vehicles.**
10. **Avoid running and scuffling.**
11. **When you select an object to stand on to reach a high place such as a shelf, pick a good substantial one. Better still —use a good ladder.**

—National Safety Council

Equipment Leases

IF A LESSOR of construction equipment desires to limit the number of hours each day that it is to be used, he should insist upon an appropriate clause in the lease contract.

This suggestion is inspired on reading the recent decision of the Washington Supreme Court in the case of Lidral-Wiley v. United States Fidelity & Guaranty Co., 38 Pac. 2d, 346. There plaintiff sued for rent covering a shovel and other equipment leased to a highway contractor and sought additional pay because the shovel had been used two shifts a day. Denying the right to additional pay, the court said:

"There was nothing stipulated in the written contract between them as to whether the $1,550 per month for the shovel, Linn trucks, air compressor, jack hammers, drills, etc., was upon a one-shift or two-shift basis. Had it been contemplated that the compensation would be additional if the equipment was used two shifts per day, it would have been easy to have so stated in the written contract. This was not done."

—Arthur L. H. Street, Attorney-at-law.

Throttling Centrifugal Pumps

WHEN a contractor is using a centrifugal pump for pumping out excavations it is a convenience to have some means of regulating the flow. During the early part of the day it is necessary to pump considerable water so that the work can be started, while later it is only necessary to take care of the seepage. If the pump is connected to a variable speed power supply the amount of water pumped can be easily regulated by varying the speed of the pump. Regulating the speed is the most efficient way of regulating the flow. In many cases, however, the pump is driven by a constant speed electric motor. In such a case the amount of water pumped can be regulated by throttling the discharge. Throttling does reduce the amount of power taken by the pump but not reduce it as much as a lowering of the speed. A valve in the discharge line is handy and is, naturally, the best thing to use for throttling as a very close variation may be obtained. A large valve, preferably of the gate type, is not always available and in the larger sizes is quite an expensive proposition.

A very good throttle can be made by bolting a plank over part of the discharge opening across a flange. The idea is shown in the accompanying sketch. With a few trials it will be found that the pumping rate can be regulated to suit the conditions. Such a device will make it unnecessary to stop and start the pump frequently when only part of the capacity is needed.

—K. B. Humphrey.

EXCAVATING ENGINEER
FOUNDED 1905

A Monthly Publication Devoted to Excavating and Allied Subjects

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The Business Situation

"BUSINESS is better." How often we have heard this statement in the last few months, and yet how often have we had to listen to a qualification of the statement.

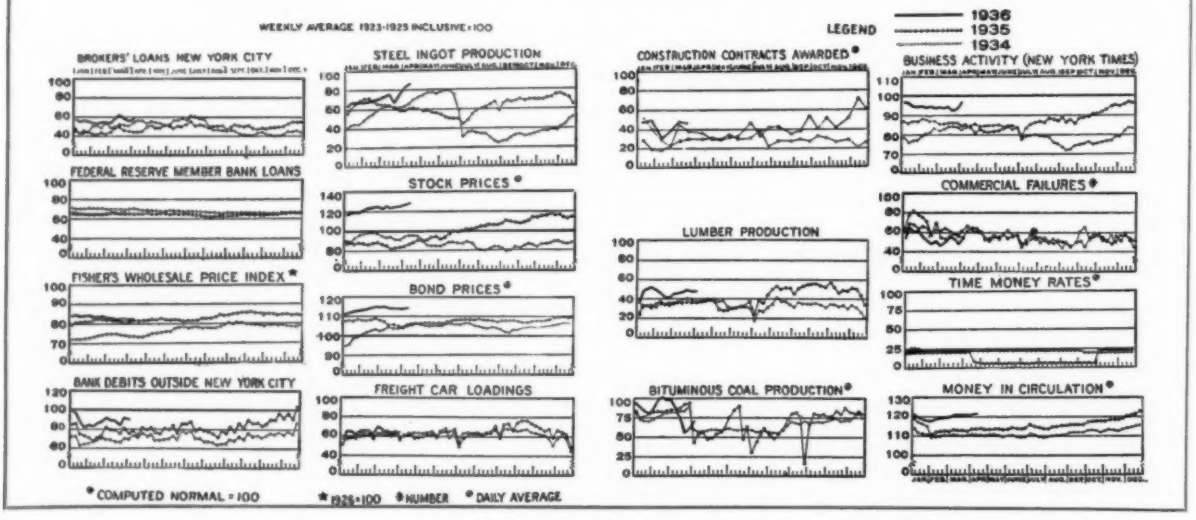
Business does seem to be better; but like most people whom you hear make this remark, we feel that qualification is necessary. There is much danger in the present situation. One very real danger deserves special attention. It is one which can, apparently, be corrected only by the joint action of everyone concerned—the people of the United States.

In 1929, the combined income of everyone in the country amounted to $78,900,000,000 and the total taxes, including Federal, State, and Local amounted to $9,800,000,000. This means that, in 1929, 12 per cent of the national income was collected as taxes and spent by the government. About one dollar of every eight earned by the individuals of this country was handed over by them to their government for purposes of handling governmental business. Today we face a condition where the percentage of income paid for taxes is just about double what it was seven years ago. The figures for 1934 are: national income, $49,900,000,000; taxes $9,500,000,000. Thus, in 1934, 19 per cent of national income was collected as taxes by government, and yet only covered a part of governmental expenses. The final figures for 1935 are not yet available, although the press is quite generally giving figures varying from one dollar in four to one dollar in three. Whatever the final figure for 1935, you can rest assured that it will be decidedly higher than the figure of one dollar in every five for taxes, as it stood in 1934; and, one dollar of every five is entirely too much to pay for the services rendered by government.

But, that is only part of the story, only part of the reason why every individual should realize that government affairs are *his business*. A matter which is still greater cause for thought is that, during the past few years, the government has not been living within its income. During the last several years our government has been spending money far beyond the ability of the people currently to pay. We have been operating on budgets that have been so unbalanced that today the national debt amounts to over $35,000,000,000 — and bids fair to be over $36,500,000,000 by the end of the year. This is a far greater sum than the government of the United States has ever owed before. It is a sum which can only be paid in three ways: by the repudiation of the debt, by inflation (which amounts to exactly the same thing as repudiation), or by heavy taxes in the coming years. And, the irony of the situation is that heavy taxes always have meant inflation, higher cost of doing business, higher cost of living, and resulting upheavel and maladjustments in the life of every citizen.

It is the duty of each American, whether he be a mechanic, laborer, farmer, professional or business man, to do everything in his power to bring his Federal, State and Local governments to a definite realization that, not only must governmental budgets be brought into line with the ability of the country currently to pay, but current expenditures must be brought down to a point where current taxes will not only cover them, but also help reduce the appalling public debt that we have run up in the last few years of profligate spending. All right thinking citizens should insist that all candidates for public of-

WEEKLY BUSINESS INDICATORS



fice in the coming elections pledge themselves to an elimination of governmental extravagances.

A Century of Progress

ATTENTION has been called elsewhere in this isue to the Centennial Anniversary of The Ensign-Bickford Company, manufacturer of safety fuse and Cordeau-Bickford.

Looking back to the days before the invention of a safe and sure fuse, the wreckage, shattered lives and waste directly chargeable to the crude methods employed in blasting, make it appear particularly fitting that special attention be given the celebration of the one-hundredth anniversary of this Company whose history is the history of safety fuse.

Blasting a century ago was handled chiefly by black gunpowder which was ignited by means of a torch, glowing tinder, or heated iron rod. A train of fine powder led to the main charge and provided the interval of time for the firer to reach safety. Later, goose quills, packed with powder by hand and joined not unlike the child of today makes a dandilion wreath, were used to fire the charge. The results of these methods requires no great imagination. Misfires, premature explosions, and general uncertainty were the rule—not the exception.

To William Bickford, therefore, goes the gratitude of countless blasters' wives and dependents, not to speak of the answered prayers of the powder men themselves. And because The Ensign-Bickford Company traces its origin directly to the great benefactor of Cornwall, England, gratitude for performing flawlessly a service to humanity is theirs, too.

It is difficult to realize how modern industry could survive without a safe and sure safety fuse. Certainly the United States and the world would not have reached the present advanced stage of industrial and commercial development had it not been for modern blasting methods. Even a perfunctory glance through the running history of excavation which we have published for the past thirty odd years discloses many hundreds of great projects successfully carried out without loss of life or serious injury because of safety fuse; many a project that could hardly have been put through at all had not safety fuse and Cordeau been available.

Silas B. Mason

THE nation lost one of its best-known and respected contractors with the death on April 14 of Silas Mason. He was stricken with a heart attack in his office at Mason City, Washington, and was removed to the hospital, where he died shortly after his arrival.

Mr. Mason was president of the New York general contracting firm of Silas Mason, founded by his grandfather in 1830. He was chairman of the Mason-Walsh-Atkinson-Kier Company, formed to build the foundation dam at Grand Coulee. He was also chairman of Mason & Walsh Co., and of Mason & Hagner Co., believed to be the oldest construction firm in the country.

Some of the major construction jobs completed under his leadership were: the Boston vehicular tunnel, the Chesapeake & Ohio railroad lines, two tunnels under the East River between Brooklyn and lower Manhattan, and a munitions plant built for the government during the war.

Mrs. Mason and a nephew, Sam Mason, flew to Mason City from the family home in Lexington, Kentucky.

Mr. Mason, who was 56 at the time of his death, remained conscious to the end, attending to necessary business and personal matters in the hospital. The funeral was held in Lexington on Sunday, April 19.

With Mr. Mason's passing, the contracting industry has lost one of its finest leaders.

Frederick C. Crane

IT IS with sincere regret that we announce that Mr. Frederick C. Crane, President of the F. C. Crane Company, of Dallas, Texas died April 5, 1936. Mr. Crane was born September 4th, 1877 at Aurora, Illinois. He entered the employ of the Western Wheeled Scraper Company of Aurora, Illinois at the age of seventeen. In 1912 he moved to Dallas, Texas as manager for the business of the Western Wheeled Scraper Company and continued with this Company until 1935 when he resigned to devote his time to his other interests.

Mr. Crane organized the F. C. Crane Company in 1925. He was an active worker in the Gaston Ave. Baptist Church during the entire time that he lived in Dallas. Mr. Crane had a large acquaintance among the contractors in the Southwest all of whom will regret the passing of a genial friend.

Tomorrow's Highways

IN ANY STUDY of future highway traffic problems, one fact stands out:—we must plan and build wisely now if our roads are to be adequate to meet the needs of 1960.

The 22,400,000 passenger vehicles registered in 1935 will have increased to 31,000,000 according to estimates based on a recent survey. 1960 will find 6,000,000 trucks on the roads instead of 1935's 3,600,000. The present trend towards increased speed is likely to continue. Cars will use less fuel, and consequently may be expected to travel farther. Farmers will increasingly market their goods by trucks, which will undoubtedly use diesel fuels to a greatly increased extent. Present traffic congestion in industrial areas will be appreciably increased.

All these factors—and others we cannot now foresee — will make up the motor traffic problem of 1960. How are we going to meet that problem?

The logical way is by planning. We can no longer build rural roads hit or miss. They must be planned to get farm produce to market in the most efficient way. Industrial congestion must be relieved — possibly by elevated highways. Maintenance and improvements to through highways must be such as to fit them for the fast, heavy traffic of 1960.

We are not through building highways. Millions of miles are yet to build. Thousands more must be improved to meet new conditions.

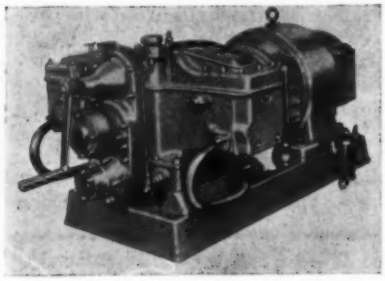
These roads will be built. It is up to us to see that they are built wisely and well.

EQUIPMENT
You Ought to Know About

Covic Diesel Engines

ACCORDING to a recent announcement, Covic Diesel Engine Company, 923 East San Fernando Road, Burbank, California, has secured the sole American manufacturing and distribution rights for the English "Victor" horizontally opposed Diesel engines, which will be manufactured and marketed in this country under the name of "Covic" Diesel engines.

The manufacturer states that after prolonged tests made under actual operating conditions on vehicle, marine and stationary applications, this small Diesel engine is all that its designers claim.



The engine is a two-cylinder horizontally opposed four-cycle, water-cooled, solid injection, cold starting Diesel with a bore of 3-9/64 inches, and stroke of 3 1/8 inches. In normal service it is claimed to produce from 15 to 18-horsepower, having a speed range of from 500 to 3500 rpm. The Bosch fuel injection system is used; pumps and nozzles totally enclosed but instantly accessible. Size is given as 19½ inches high, 19 inches long by 30 inches wide. Approximate weight claimed is 280 pounds including 60-pound fly-wheel.

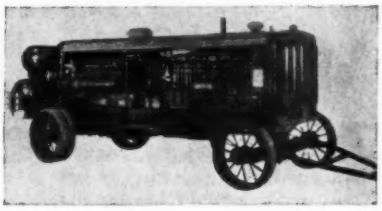
Shown above as a Diesel generating plant, this small engine is recommended by the manufacturer for use with road machinery, hoists, compressors, welders, drag-scrapers, concrete mixers, standby plants, auxiliaries for larger Diesel engines, pumping, general portable and stationary work, as well as for miscellaneous vehicle adaptation. Complete information on this new small Diesel engine will be sent by the manufacturers upon request.

New Cat Cleats Provide 2-Way Traction

INTRODUCED this month by Bucyrus-Erie Company of South Milwaukee, Wisconsin, is a new cast cleat to be attached to the links of Bucyrus-Erie cats on jobs where increased traction is desired. A patented flange provides a two-way traction that prevents slipping when moving forward and eliminates sliding sidewise when on soft hillsides, according to the manufacturer. The cleats may be used on every link, or every second, third, or fourth link, depending on the ground requirements. They are easily attached—the curved ends of the two sections hook over the outside edges of the links and the two parts are bolted together. Bolting holds the sections together in tension rather than tension and shear, and makes drilling holes in the links unnecessary. A three-point contact assures perfect seating of the cleats and prevents working loose. They are removed by merely unbolting and lifting from links. A complete line of sizes is available to fit all Bucyrus-Erie machines.

Gardner-Denver Diesel Portable Compressor

ANSWERING the need for a portable air compressor which can deliver an exceptionally large amount of air, and yet effect substantial fuel savings, the Gardner-Denver Company has just announced its ABH 420-D two-stage, water-cooled compressor powered by "Caterpillar" Diesel engine.



This compressor delivers 420 cu. ft. of air per minute, according to the manufacturer. They claim that, on less than 6 gallons of 6-cent fuel oil, it will operate at full capacity for one hour—a fuel cost of under 36 cents per hour. The over all length is 16′7″; total weight, 18,000 pounds. For complete details write Gardner-Denver Company, Quincy, Illinois.

New Portable Screw Driver Announced

A PORTABLE electric screw driver, smaller in size, lighter in weight and capable of driving all sizes of screws from

No. 4 to No. 12 by simply changing the finder and bit, has been introduced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago. This new Thor U16 Electric Screw Driver is radically different in design and construction, following the design of the U14 smallest electric drill ever built, recently announced, and incorporates features never before built into an electric screw driver, according to the manufacturer. All weight is concentrated right at operator's hand, eliminating overhanging weight and providing easy, untiring operation with "finger-point" accuracy, making the tool in fact a real one-hand tool. The smallness of the screw driver, only 10½" overall, permits use in places ordinarily inaccessible. A powerful motor, dependable tension adjustment, hand wound armature and special commutator construction provide efficient operation.

Four Bucyrus-Armstrong 26 Blast-Hole drills at Passamaquoddy Tidal Power Project near Eastport, Maine.

4 in a row!

IT IS HARD for an old-time driller to realize how much hole a battery of *modern* Bucyrus-Armstrong blast-hole drills can put down in a single working day. With these machines, the drilling motion has the SNAP that means a new kind of shattering, penetrating blow. The sturdy construction and ample power mean a heavy, hard-hitting string of tools and more blows per minute. Large diameter holes, wider-spaced, decrease number of set-ups necessary, with no increase in powder cost. Modern crawler mountings make rapid moves over rough ground surfaces. Bucyrus-Armstrong blast-hole drills have the new and modern features that *count*—wire-line cable, rubber shock-absorbers, all-welded steel frame and derrick, easy and convenient controls, and a multitude of other advantages that make possible fast, low-cost, year-in and year-out blast-hole drilling. Whether your need is for one drill or a dozen, Bucyrus-Armstrong offers you the most for your money. Send today for bulletins on complete line of drills.

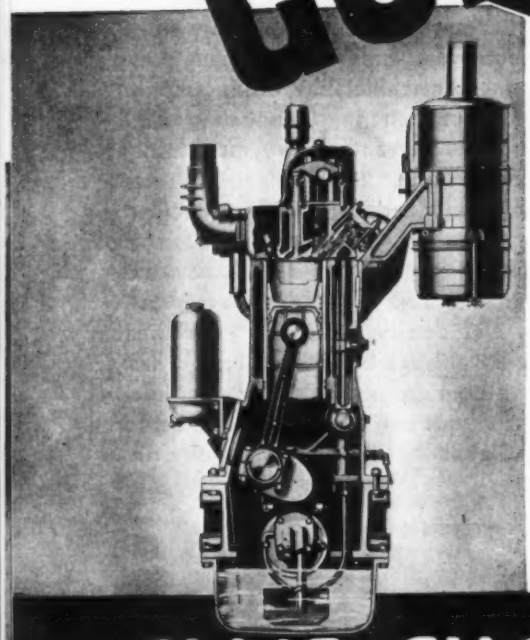
BUCYRUS ARMSTRONG

162

BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.



ONLY ALLIS-CHALMERS GI

CONTROLLED IGNITION

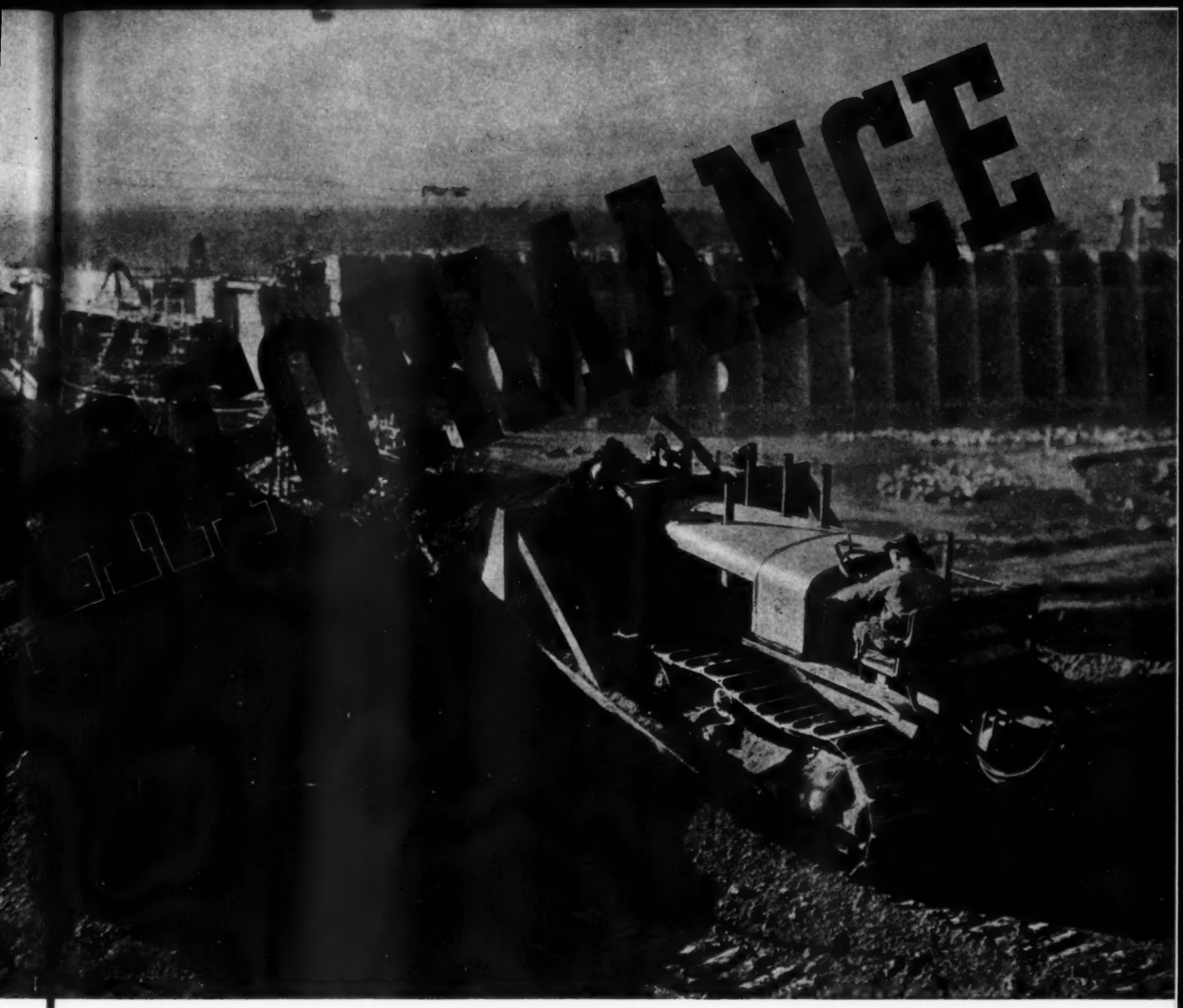
In the Controlled Ignition Oil Tractor, Diesel fuel oil is injected into the combustion chamber at 60° before top dead center—which provides ample time for thorough mixing with the air. At exactly the proper point, this mixture is ignited with a spark. Because the *ignition point is controlled*—there is no danger or chance of power-wasting pre-ignition. This improved system is **not** dependent on split-hair adjustments; the vibration problem is eliminated; heavy, unbalanced parts are unnecessary: power and weight are *balanced* for maximum performance. Only the *Controlled Ignition* Oil Tractor has these advantages.

CONTROLLED *Instant* START

Regardless of weathe Controlled Ignition O gine starts easily a stantly. There is no for complicated, exp starting devices. Tw three upward pulls o crank—or a push on the starter—and away she goes. Time saved in starting is time for useful work. Only Allis-Chalmers gives you this advantage.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS



YOU THESE IMPORTANT ADVANTAGES

CONTROLLED INJECTION OF FUEL

An accurate charge of fuel is sprayed (not squirted) into the combustion chamber — regardless of load or throttle setting. Simplest fuel pump built — serviced without special tools; separate, individual unit for each cylinder. New type injector permits accurate measuring at idle speed. Nozzle valve protected from heat of combustion chamber.

CONTROLLED AIR-FUEL RATIO

Just the right amount of air for efficient combustion of fuel at *all* loads and *all* speeds. Correct air-fuel ratio *eliminates* an excess of air at idle speed — which would lower exhaust temperatures *at the expense of power.*

Now you can have fuel economy without the handicaps of high compression ignition. Now you can burn low cost Diesel fuel oil and—*in the same tractor*—you can enjoy the advantages of simple, instant starting... easy, inexpensive servicing... unexcelled lugging ability ... freedom from vibration "whip"... without heavy, expensive parts and hair-line adjustments. All this at low first cost and unequalled economy of operation. Only the A-C CONTROLLED IGNITION OIL TRACTOR gives you this combination of vital advantages.

WHAT PERCENTAGE OF YOUR DOLLAR GOES FOR LAY-UP LOSSES?

The larger and more expensive your tractor — the greater your loss per hour when the tractor is down for repairs. Allis-Chalmers tractors reduce lay-up losses in two ways: (1) Lower investment per tractor (2) Controlled Ignition assures dependable performance.

SHOTS *from the Firing Line*

Safety Fuse Enters Second Century

ONE HUNDRED years ago, the firm of Bacon, Bickford, Eales and Company was organized to manufacture and sell safety fuse in this country.

Safety fuse was invented in England in 1831 by William Bickford of Tuckingmill, Cornwall. He saw only too well reflected in the lives of the miners about him the inadequacy of existing blasting methods. While watching a friend at work in a rope-walk, it occurred to Bickford that if a funnel could be fixed to pour gunpowder in the center of the yarn as it was spun into rope, and if the rope could then be coated with an enclosing substance, a slow-burning fuse could be obtained.

The idea was patented, and the firm of Bickford, Smith and Davey began the manufacture of safety fuse.

Richard Bacon, superintendent of the Phoenix Mining Company of Simsbury, Connecticut, heard of the English firm and arranged with them to produce fuse in the United States.

Machinery was sent from England, and in 1839 Joseph Toy, a bookkeeper with the parent company, came over to assist Bacon, Bickford, Eales and Company. He became a junior partner when Eales retired. A fire in 1851 destroyed the original plant at East Weatague, and a new one was built at Simsbury, where the firm name was changed to Toy, Bickford and Co.

Attempts were made to establish competing firms; but when new machinery arrived from England, capable of making fuse in continuous lengths instead of the old 60-foot pieces, these early competitors dropped out or were bought by Toy, Bickford & Co.

In 1863 Ralph H. Ensign, who had married a daughter of Joseph Toy, entered the business. In 1867 L. E. Ellsworth was sent to California to establish a factory as a market was developing there and transportation charges made it too expensive to ship fuse from Connecticut. Because this market was limited, and competition there keen, the California Fuse Association was formed. In 1903 a further consolidation resulted in the present independent Coast Manufacturing & Supply Company.

Upon the death of Joseph Toy in 1887, Ralph Ensign became managing partner of the Connecticut concern, which changed its name to Ensign, Bickford & Company. In 1907, the Ensign-Bickford Company was formed by a consolidation of the Climax Fuse Co., a competing concern at Avon, Connecticut.

A major step in fuse history was taken in 1913 when the Ensign-Bickford Co. introduced Cordeau-Bickford in the United States. This detonating fuse, consisting of a lead tube filled with trinitrotuluene, was invented in Paris, France, by Louis L'Heure. Because it has a rate of burn of three miles a second, it permits the simultaneous firing of many blasts, and has found wide use in quarry work.

In celebration of the hundredth anniversary of the introduction of safety fuse, the Ensign-Bickford Co. is issuing a centennial booklet containing a detailed history of safety fuse which may be obtained by writing to them.

• *Before the invention of safety fuse, blasting was done with gunpowder. Charges were ignited by makeshift fuses of straws or goose quills nested together and filled with fine powder. As a result, blasts often fired too soon, too late or not at all.*

Unusual Safety Record Achieved by Bureau of Explosives

THE railroads of the United States and Canada, during 1935, transported approximately 370,000,000 pounds of dynamite and black powder with a safety record of no one killed, none injured, and no property damage. This safety record for the past year became known with the publication of the annual report of W. S. Topping, chief inspector of the Bureau of Explosives, which operates under the direction of the Association of American Railroads.

The safety record for 1935 is a continuation of the unusual record established by the Bureau of Explosives in the transportation of dynamite and black powder since 1927. Since that date, there has been no explosion, no person killed, and no person injured.

Army Engineers to Complete Island Site for 1939 San Francisco World's Fair

By C. W. Geiger

THE ISLAND now being built by a 19,000,000-yard sand fill on the Yerba Buena Shoals in the bay between San Francisco and Oakland will serve a double purpose. First, it will house the World's Fair which will celebrate the completion of the great bridges connecting the two cities. Then when the Fair is over, the island will be used for an airport.

The work is being done by U. S. Army Engineers, following the failure of private contractors to bid on the job. Recently, Lt. Colonel J. A. Dorst, U. S. Army district engineer, announced that the War Department had approved plans for continuing the work. The job will be completed within the 15-month schedule; more than 1,300,000 cubic yards of the fill having been placed by the end of March. Three suction, and two hopper, dredges will be used, and necessary supplementary equip-

BUCYRUS-MONIGHAN

ignores rainy weather, soft ground and treacherous footing. It has a double set of supporting surfaces . . . more than double the bearing utilized by other types of draglines. When digging it is supported only on its large-area base. When walking, it is supported partly on the walking treads and partly on the base. Treads and base get fresh bearing surfaces for every move! Manufactured by Bucyrus-Monighan Company, Chicago, Illinois.

Bucyrus-Monighan Special 6160 Electric Dragline, working in the rain on the Bonneville Dam for Columbia Construction Company

BUCYRUS MONIGHAN

Sold by BUCYRUS-ERIE CO.
SOUTH MILWAUKEE, WISCONSIN, U.S.A.

280

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

Model of the 430-acre World's Fair site and airport near Yerba Buena Island, as it will appear in 1939 when the great bridges connecting Oakland and San Francisco are completed. The latter city is shown in the background.

ment leased from private dredging companies by the U. S. Army Engineers.

A separate contract will be let for placing 200,000 tons of stone in the three-mile retaining wall around the site. Ben C. Gerwick, Inc., have a contract for pile driving to provide triangulation stations, range piles and shore connections for pipe lines.

The location of the 430-acre fill, close to Yerba Buena Island, will permit an excellent view of the Fair and airport by all users of the bridges. The site has many qualifications for an excellent airport. It is close to the San Francisco business district. It is easily accessible from the entire metropolitan area of Oakland and San Francisco. Its location in the bay provides minimum hazard to population and property, and at the same time minimum flying hazards, room for expansion, and good approaches. Via the bridges, the airport will be close to transportation connections.

Work Hits Full Swing at Fort Peck

THE Army Engineers have issued a call to contractors for the manufacture and installation of the emergency gates for the Fort Peck tunnels. Bids will be opened May 21, 1936. These gates will be of the Stoney type in the form of vertical lift doors which will normally be held in a raised position until they are needed to stop the flow of water through the tunnels in case of accidental damage to the main gates. The designs for the main ring gates have not yet been completed, therefore, their construction is not included in the present call for bids, which is for the emergency gates only.

The centerline of each emergency gate shaft is 71 feet 9 inches up-stream from the centerline of each air main shaft. Two gates will be used in each emergency shaft. Therefore, for the four diversion tunnels, eight gates will be required.

The contract will include four reinforced concrete buildings over the tops of the shafts and one substation building. Each gate house will be 21 feet 6 inches wide by 39 feet long and 60 feet in height. The gate-raising machinery will be mounted on the second floor, 38 feet above the ground. Access to the hoisting machines will be by a spiral stairway. The metal gates, suspended from large chains, will be 11 feet 6 inches wide, 22 feet 3 inches high, and 4 feet 6 inches thick. They will have roller bearings moving against bronze bearing-plates for ease of operation.

A substation building, 30 x37 x 23 feet high, located between number two and three main shafts, will house the electric transformers required to step down the power voltage from 4160 to 230. Inside each gate house a motor-generator will provide direct current for use in the hoist motors, as is the practice for passenger elevators in office buildings.

In addition to the various metals used in the gates themselves, the contractor will be required to furnish 2,168,000 lbs. of steel and 1,431,000 lbs. of bronze. Local employment will not be increased greatly on account of this contract since most of the work will be done in the factory. Probably only assembly and installation labor will be required locally.

After the contract has been awarded to the lowest bidder, he will be required to commence work within 30 calendar days after receipt by him of notice to proceed. Initial work will be done at the factory. The work of installation in the tunnels at Fort Peck is scheduled to begin in Nos. 1 and 2 tunnels about November 15, 1936. The entire work under this contract must be completed before June 1st, 1937.

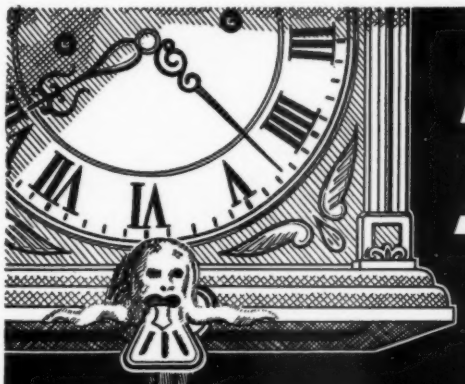
The architecture of the gate houses (which will be similar to each other) and of the transformer building, will correspond with that of the Administration Building in the townsite.

All previous records for enlargement excavation of the tunnels were shattered in Nos. 3 and 4 tunnels during the week of April 9-16th. During this seven-day period the heading in No. 3 was advanced an average of 20.7 feet per day, while No. 4 advanced at an average rate of 23.0 feet per day. This is by far the best progress which has been made to date on this type of work in the Fort Peck tunnels.

Rapid progress is being made in No. 1 tunnel. The concrete base has been poured in the main shaft and the platform jumbo used at the heading is being taken through the shaft foundation so that it can be used on the final lap of excavation finishing at the inlet portal.

In No. 2 tunnel, the steel forms used for pouring the invert of the concrete lining have been set up and used for three pours since they were reduced to the smaller diameter. The sidewall and arch forms are being set for their first pour. The smaller diameter of the forms means that the concrete lining is now 45 inches thick. Large numbers of heavy reinforcing bars must be placed ahead of the pouring operations so

● *The mixing plant, trestle for concrete trains, and the exposed bedrock where concrete is now being poured at the Grand Coulee.*



TIME PROVES *there is a difference* *in* WIRE ROPE!

The real difference in wire rope shows up after the rope has been put to work—after it has stood the test of time.

"HERCULES" (Red-Strand) Wire Rope can always be identified—even after the red wears off the colored strand—by its superior service. After all, the color is only paint deep, but what it symbolizes goes deeper. "HERCULES" (Red-Strand) Wire Rope shows its true color by giving you longer service on the job.

Time on the job proves the qualities that are built into a product—and that's particularly true of "HERCULES" (Red-Strand) Wire Rope. It is then that you notice the results of 79 years of rope making experience, rigid wire tests and acid open-hearth steel wire.

Make the "test of time" yourself by specifying "HERCULES" (Red-Strand) Wire Rope on your next order. You'll discover *there is a difference.*

Made only by

A. LESCHEN & SONS ROPE CO.

Established 1857

5909 Kennerly Ave., St. Louis, Mo.

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SAN FRANCISCO	520 FOURTH STREET

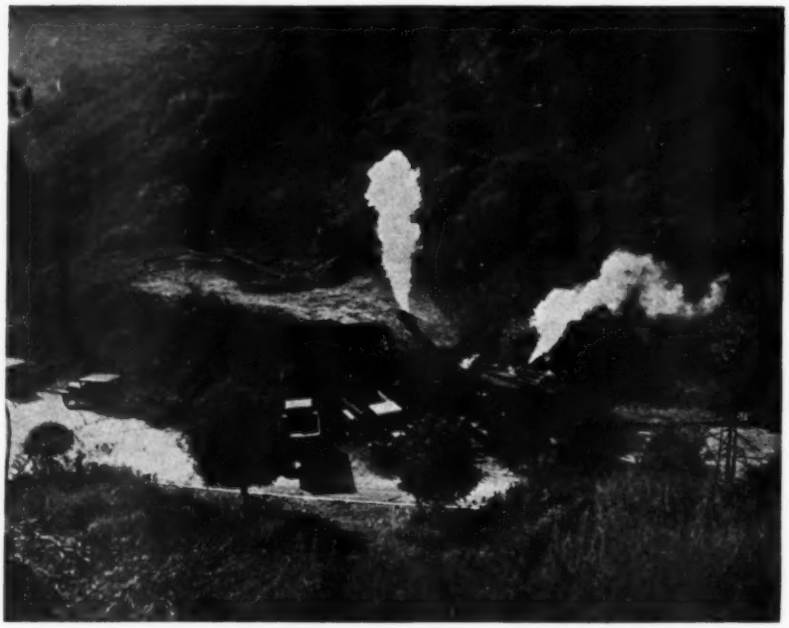
For your convenience in writing to A. Leschen & Sons Rope Co., you will find a card bound in this issue.

that they will be imbedded in the finished concrete. The means used to install these bars and to hold them in position while the concrete is being placed are very ingenious. A steel-frame gantry mounting wooden platforms at various elevations enables the steel setters to fix the bars in position as fast as the concreting operations can be carried on.

All four of the emergency gate shafts have been excavated and No. 1 main shaft as well. There remains 44 feet to go in No. 2 main shaft; 66 feet in No. 3; and 85 feet in No. 4.

At the inlet portals, excavation for the placing of steel wales and raker beams is under way for two sections of the inlet portal wall.

Dredging operations for the 1936 season got off to a fine start and fill is now pouring steadily into the dam from four units. The work of overhauling the dredging plant during the winter seems to have been very well done inasmuch as all units are maintaining a very high daily working average without exasperating shutdowns.



• *This Bucyrus-Erie steamer is digging out site for a future movie home on a mountainside near Hollywood. Looks as though the owner of this home wouldn't be overly troubled with next-door neighbors.*

Heat and Shifting Sands Chief Problems in Excavating for All-American Canal

INTENSE HEAT and shifting sands are tough proving grounds for men and machines, and both are very much present at the construction of the All-American Canal. Temperatures have risen as high as 130 degrees in the shade—and it's hard to find much of that. A highway depot between the Colorado River and the Imperial Valley cities of Calexico and El Centro wages a continual battle to keep sand from burying the roads.

In the face of such conditions, Diesel-powered tractors, draglines and power shovels are doing remarkably good jobs. One veteran Bucyrus-Erie dragline, powered with an Atlas 6-cylinder Diesel engine, and owned by the Construction Company of New Orleans, is spoken for by its operator. He says:

"This baby is seven years old and still going strong—it should have service stripes. It's moving 200 yards an hour with a 4-yard bucket. Works 24 hours a day and burns 100 gallons of Diesel fuel in that time. Hasn't cried 'father' in the hottest weather, either."

Cantaloupe and lettuce will probably be the chief crops in the land which will be irrigated by the All-American Canal. Farmers in the Imperial, Salt River and Salinas Valleys have long since worked out their "programmed farming." Consequently, the ever- essential water which will be insured by the All-American Canal will be used efficiently by men who have had to get maximum benefit from available water.

• *Moving 200 yards an hour in spite of intense heat and shifting sands along the All-American Canal. This Bucyrus-Erie dragline swings a 4-yard bucket, is Atlas Diesel-powered.*

Future Homes for Movie Stars

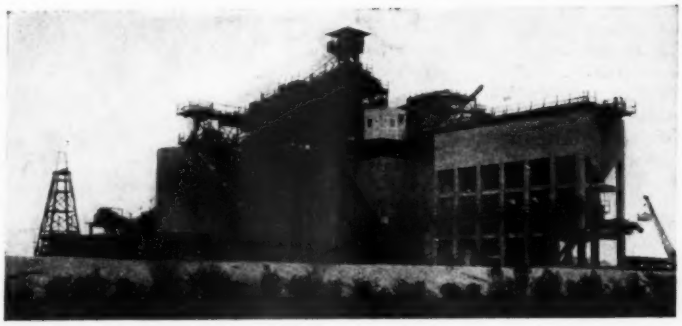
THE MOUNTAINS outside of Hollywood, California, offer some seclusion to movie stars who want homes away from the bright lights of town. Contractor T. E. Robbins of the Seabord Engineering Company, Los Angeles, California, moved 1300 yards of dirt in three days preparatory to putting in the foundations of such a home. Approximately 2500 feet above sea level, he used an Erie steam shovel to dig out the side of a mountain. Dirt was hauled by truck to fill in on another project. C. E. Toberman of Hollywood developed the property.

Plenty of Irrigation Water for West in 1936

SNOWFALL on the principal watersheds in the west has guaranteed an ample water supply this season for all Federal reclamation projects.

John C. Page, Acting Commissioner, reported today to Secretary of the Interior Harold L. Ickes that water prospects are brighter for the 1936 irrigation season in the arid and semi-arid west generally than in any year since 1929.

"The reservoirs on Federal reclamation projects are continuing to fill with every indication of an abundant water supply," Page said. "The total storage early in March, exclusive of Lake Mead formed by Boulder Dam, was 9,000,000 acre feet, an increase of 800,000 acre feet over January and an increase of



When Contractors go Diesel they go ATLAS

In the construction industry, where big jobs have to be completed on schedule, that's where machinery takes a beating. Contractors can't afford to baby their equipment — they have a job to be completed — if the capacity of their equipment has to be overtaxed to do the job, it's done. No matter what the job, the equipment has to be able to "take it".

That's the big reason behind the contractor's preference for ATLAS DIESELS. He has used ATLAS DIESELS for years for powering his shovels, draglines and locomotive cranes. He has used them in his locomotives, and as portable power units. They have run his air compressors and his water pumps. He has had them in his tow boats. He knows from experience that he can depend on the ATLAS DIESEL.

Pictured here are three applications of Diesel power as employed by the Kaiser Paving Company at their huge aggregate plant, at Pleasanton, California. This plant, one of the largest and most modern of its kind in the world, has a capacity of 900 tons per hour, and provided most of the aggregate used in the construction of the San Francisco Bay Bridge.

Shown above is a general view of the plant. At the left below is an ATLAS DIESEL powered Brownhoist loading a gondola soon to be "taken away" by the ATLAS DIESEL powered Plymouth Locomotive shown in the foreground. At the right below is an ATLAS DIESEL powered Monarch 75 Tractor, still in daily service for Henry J. Kaiser, the man who pioneered the Diesel tractor.

If you have a power application — stationary, portable or marine — where you need dependable and economical power — buy the Diesel that has proved itself in the construction industry. That's the ATLAS DIESEL.

ATLAS IMPERIAL DIESEL ENGINE CO.

OAKLAND, CALIFORNIA :::: MATTOON, ILLINOIS

ATLAS IMPERIAL

For your convenience in writing to Atlas Imperial Diesel Engine Co., you will find a card bound in this issue.

Handy Hoist

Around shovel or dragline, in the machine shop or repair shop, in plant, mine, or pit—wherever machinery or other heavy objects must be lifted—you'll find the Handy Hoist saving you time and money every working day. It lifts or pulls—up, down or sidewise. The Handy Hoist is light in weight, and is easy for one man to handle. Sturdily built, it carries a large safety factor. Made in five convenient sizes—¾, 1½, 3, 4½ and 6 ton capacities. Send for descriptive bulletin.

BUCYRUS ERIE

22A

BUCYRUS-ERIE

EXCAVATING, DRILLING & MATERIAL HANDLING EQUIPMENT • • SOUTH MILWAUKEE, WIS.

approximately 1,200,000 acre feet over the same period last year. Lake Mead came into existence only 13 months ago and it is not proper that the 4,000,000 acre feet of water it now contains should be counted when comparing the total of storage this year."

Present storage will increase greatly with the melting of snows at the higher levels. While the spring thaws in the east have come and gone with disastrous floods, much of the snow in the high mountains of the west remains on the ground. The advent of spring there, however, threatens no flood damages this year. The Colorado River, the most dangerous in the west, now is controlled by Boulder Dam, which stopped a major flood last year and which this year again will render harmless a great rush of water.

Where prior to completion of Boulder Dam and Lake Mead, tens of thousands along the lower river would have been most apprehensive at this season,

Automotive Engineers Meet in Milwaukee

ON APRIL 15 and 16 the Society of Automotive Engineers held its national tractor meeting at the Schroeder Hotel, Milwaukee. An extremely good turnout testified to the interest in the five "star" sessions. The Wednesday morning session was featured by a paper, "Tractors and Industrial Power Equipment in Highway Maintenance and Construction," given by E. L. Roettiger, Chief Engineer of the Wisconsin State Highway Commission. Mr. Roettiger called attention to the necessity for improving roads continually as the vehicles using them are improved. He said: "Complete modernization of all highways will probably never be accomplished, and obsolescence of roadways will be reduced to a minimum only after the vehicle approaches its ultimate development."

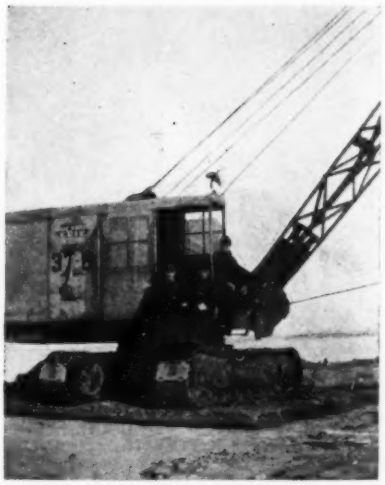
Highway Department moving pictures were shown, illustrating the use of modern power equipment in building and maintaining highways. As part of the discussion following the paper, H. B. Dodge of the Four Wheel Auto Drive Company showed pictures of snow removal in Wisconsin and Minnesota.

Succeeding sessions include a demonstration trip through the Waukesha Motor plant; a paper on U. S. Army mechanization, by Major John K. Christmas; a paper on fuel economy in aircraft engines by R. W. Young, Wright Aeronautical Corporation; and three papers on tractor engine fuels.

Work Begun on Gravity Main Canal in Arizona

CONSTRUCTION of a 17-mile section of the Gravity Main Canal of the Gila Federal Reclamation Project in Arizona, on bids totaling $955,175, has begun.

The work is divided into four schedules. Boyce and Igo, of Baton Rouge, Louisiana, were awarded the contract



• *Sometimes in water up to wheel sprockets, this 37-B, belonging to Taylor & Taylor, St. Paul, Minnesota, worked on Universal Construction Company's highway job at Ashland, Wisconsin. For 6 weeks, 24 hours a day, this machine dug muck, picking out "log trees 3 feet through," and banked sides so sand could be pumped for roadbed. No breakdowns; no repairs; only 3 drag cables used.*

on a bid of $273,600 for schedules one and four, schedule one consisting of a 26,450-foot segment at the head of the canal near Imperial Dam and schedule four consisting of excavation of a 52,460-foot segment east of Yuma.

The Mittry Brothers Construction Company of Los Angeles was awarded the contract for schedules two and three, each of which includes excavation

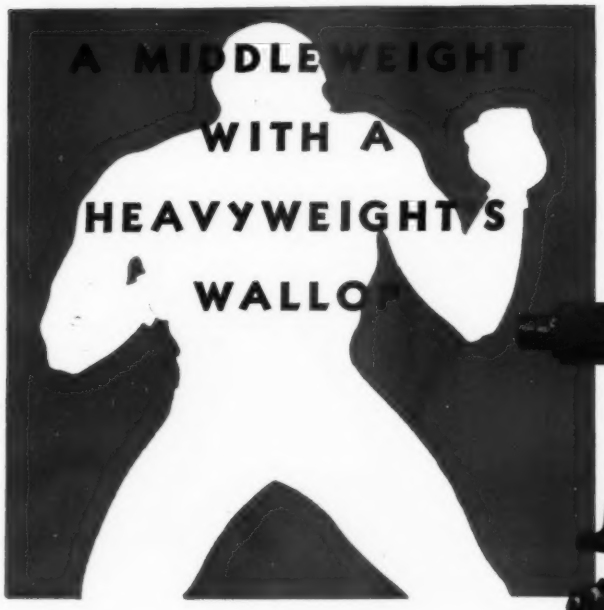
MULTIPLE-ROPE, POWER-ARM, POWER-WHEEL, DRAGLINE BUCKETS

THE DIGGING DEMONS!

A comparison of output speaks loudly in favor of Williams Buckets. *Write for Bulletins.*

THE WELLMAN ENGINEERING CO.
7002 Central Ave., Cleveland, Ohio

WILLIAMS BUCKETS



SULLIVAN'S NEW L-2 45-lb. ROCK DRILL

Truly a fighter; the outstanding performer in its class. Why? Because it offers superior drilling speed which has been brought about by successfully combining a snappy valve action, with a powerful, heavy force of blow, a strong rotation, and exceptional hole cleaning ability; because it also offers ease of operation due to modern, well-balanced design; and proven, low upkeep costs, which in turn are the results of skilled workmanship and a careful heat-treatment of fine material. There are other features, but put L-2s on *your job* and thereby discover the *real value* this machine has for *you!*

REAL PERFORMANCE!

SULLIVAN MACHINERY CO.

307 N. MICHIGAN AVE., CHICAGO, ILLINOIS

SULLIVAN makes Rock Drills & Accessories, Air Compressors, Detachable Bits, Coal Cutters, Hoists, Core Drills

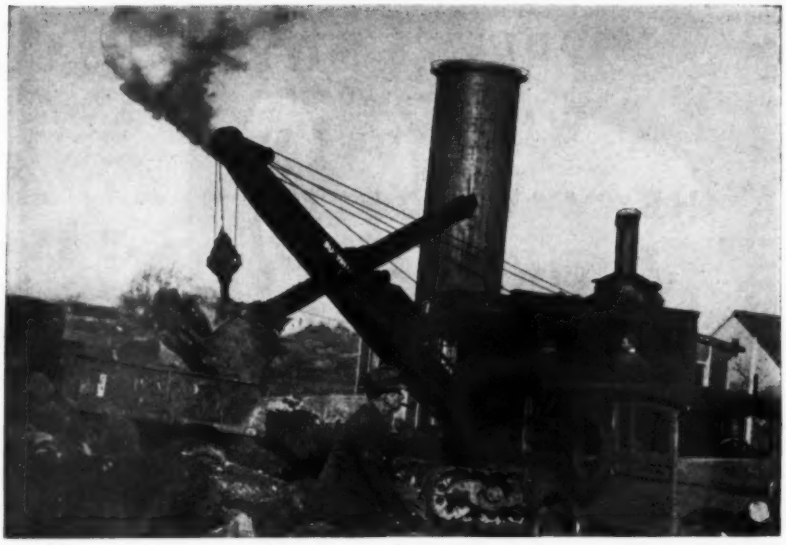
For your convenience in writing to Sullivan Machinery Co., you will find a card bound in this issue.

of a tunnel as well as excavation of segments of the canal. Their bid was $681,575 for this work.

These are the first contracts let in connection with the Gila project, the construction of the first unit of which was authorized by the President when he approved an allotment for it of $2,000,000 of work relief funds. The first unit consists of 150,000 acres, nearly all of which is public land, in the desert east of Yuma. There are a total of about 600,000 acres which eventually can be irrigated in this project. Water will be taken from the Colorado River at Imperial Dam, which also will serve as a diversion point for the All-American Canal in Southern California.

The Gravity Main Canal will be excavated to a bottom width of 22 feet, except at the sites of wash crossings and other permanent structures where it will be excavated to the full 100-foot width necessary when all the units of the Gila project are completed.

The two tunnels involved in this contract will be 1790 feet and 4110 feet long, respectively. They will be 20 feet in diameter, a size sufficient to carry the water which will be needed for the ultimate development.



• *Edmond S. Rappoli, well known Cambridge contractor, has received the contract to build the new addition to the Marblehead High School, which promises to be one of the largest and finest equipped schools on the North Shore. The estimated cost for the construction is about $375,000. Shown here is Mr. Rappoli's Bucyrus-Erie steam shovel, a veteran which has excavated for many state buildings and Post Offices in New England.*

Atlantic-Gulf Canal Must Be Approved By Congress

CONSTRUCTION of the Atlantic-Gulf Ship Canal in Florida will stop when present contracts expire in July unless Congress approves further funds. This became apparent when President Roosevelt stated that no more funds will be allotted either this canal or the Passamaquoddy power project without Congressional approval. No relief funds will be provided on the present basis for either project.

ARBA Objectives Announced at Annual Meeting

HIGHWAY construction offers to the administration the most appropriate method of encouraging private industry to provide greater employment, it was asserted by Colonel Willard T. Chevalier, new president of the American Road Builders' Association, in his inaugural address delivered at the recent Annual meeting of the Association in Washington, D. C.

Colonel Chevalier reminded the Road Builders that President Roosevelt has emphasized the necessity for private industry and private enterprise to resume the burden of employment, and added that "the construction industry is the particular form of enterprise that has been hardest hit of all industry, and it certainly is not helping that industry to resume the burden of employment of some Federal officials continue the policy of handling work by the day-labor method."

Chief objectives that will be sought by the A.R.B.A. under his administration as president, were listed by Col. Chevalier as follows:

1. Continuation of the Federal-aid Highway Program.

2. Restoration of the normal contract system in constructing highways.

3. Reconstruction of obsolete roads and expansion of the highway program to include greater mileage of secondary and farm-to-market roads.

4. Reduction of the highway traffic toll through a safety campaign that is directed primarily toward elimination of highway hazards.

Colonel Chevalier succeeded Mr. William McDonald as president of the American Road Builder's Association. The election was held in January, but the new president did not take office until the Annual Meeting, April 15-17, in Washington.

Contractor Brown: "What did your son learn at college?"

Contractor Green: "Wal, he hadn't been home a week before he showed me how to open bottles with a half dollar."

Long Range Excavators

On any excavating work where there is a haul of over 200 ft. it pays to consider a Sauerman Slackline or Drag Scraper. Sixteen sizes of buckets provide hourly capacities from 10 to 600 cu. yds. Economical, easy to operate. Write for Catalog.

SAUERMAN BROS.
474 S. Clinton Street CHICAGO

Sauerman Scraper on Cut-and-Fill Job

Sauerman Slackline Digging River Gravel

CONTRACTORS—

List your surplus equipment for sale in Excavating Engineer. A $2.40 advertisement may put hundreds of dollars in your pocket. We have had

BUYERS FOR

the equipment listed below among the inquiries received the past 30 days.

Used—Clamshell bucket Model M130 Owen.
Used—Dipper for ¾-yard Erie Steamer.
Used—Drag shovel attachment-General Shovel.
Used—Two drum gasoline powered hoist.
Used—Two 300-500 b.h.p. Diesel electric generators.
Used—Five 25 or 30 h.p. gasoline tractors.
Used—75 h.p. gasoline engine.
Used—5 or 7 ton gas roller with scarifier and blade.

Turn to page 268 for rate information

For your convenience in writing to Sauerman Bros., you will find a card bound in this issue.

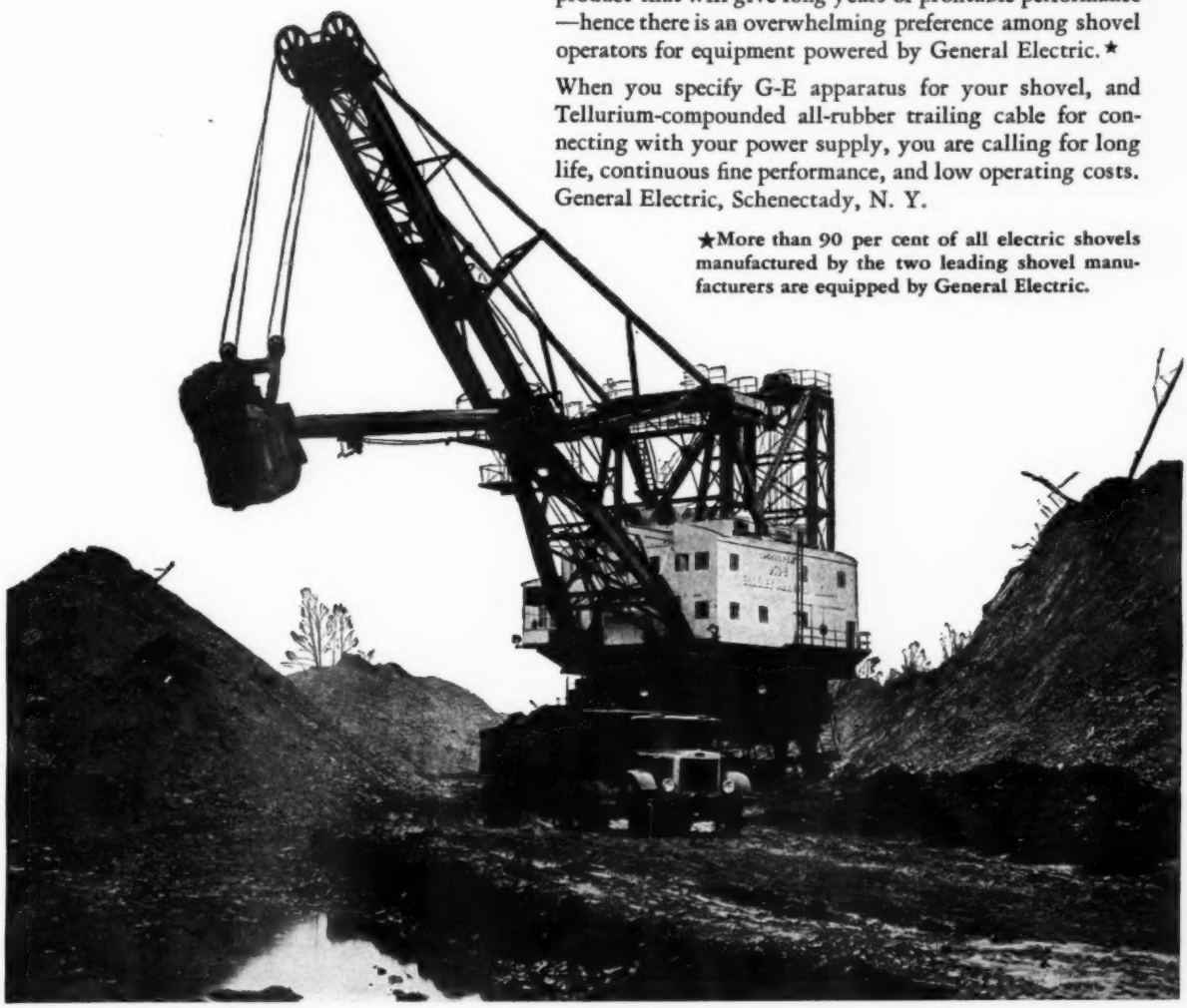
Measure Your Investment by RETURNS

WILL your shovel give you years of satisfactory performance and gratifying economies by using electric equipment suited electrically and mechanically to the requirements of your work?

Power shovels equipped by General Electric will give you these advantages, for they utilize the experience gained from many years of co-operation between leading shovel builders and General Electric. This blending of sound mechanical and electrical engineering experience yields a product that will give long years of profitable performance —hence there is an overwhelming preference among shovel operators for equipment powered by General Electric. ★

When you specify G-E apparatus for your shovel, and Tellurium-compounded all-rubber trailing cable for connecting with your power supply, you are calling for long life, continuous fine performance, and low operating costs. General Electric, Schenectady, N. Y.

★More than 90 per cent of all electric shovels manufactured by the two leading shovel manufacturers are equipped by General Electric.



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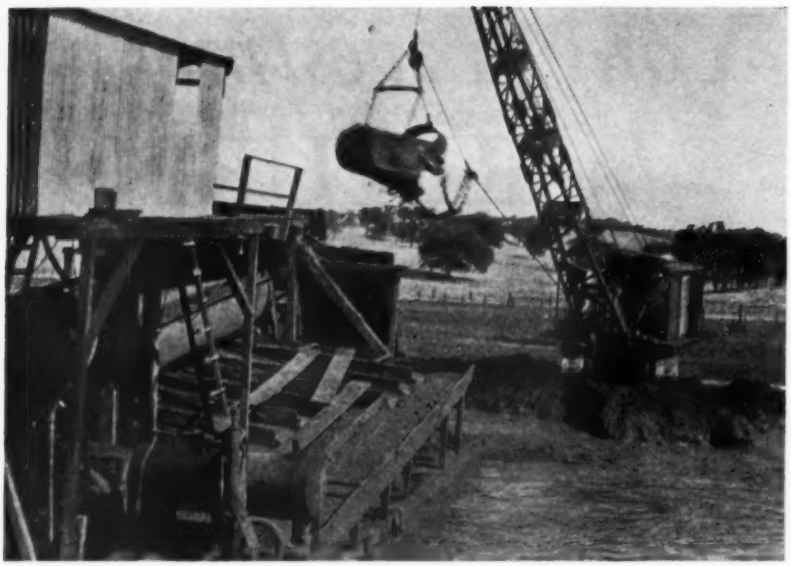
GENERAL ELECTRIC

For your convenience in writing to General Electric, you will find a card bound in this issue.



• The gold and fine sand which pass through the ⅜" dia. holes on the screen are carried by water over riffles shown here.

Digging Gold with Dragline and Doodlebug

(Continued from page 233)

Special dragline bucket used

Four men were employed on the dragline, working eight hour shifts, with one operator serving as oiler each shift. A single attendant was on the barge and two men were in the repair shop to keep in shape a spare dragline bucket and to assemble new sections of screen as fast as they wore out. These two pieces of equipment were naturally subject to major wear.

The dragline bucket was the most vitally important part of the entire project. In these gold bearing gravels the principal values are found in the foot of material just above bedrock encountered at these deposits. A special cutting lip to scoop off the top of the bedrock is used. To insure maximum reclamation of values the buckets were swapped every two days, the one removed being rebuilt by welding to its original contour.

Operators on the Bucyrus-Erie dragline were: Leonard Young, Floyd Foutch, Henry Newell and Melvin Howell. D. P. Kumle was in active charge while his partner, Joe Ferris, was superintending the operation at John Day, Oregon.

Cost of Diesel Fuel Almost Negligible

Accurate records kept indicate a fuel consumption for the dragline of 78 gallons of Diesel oil for 24 hours, during which time an average of 3,800 cubic yards of gravel was excavated. At 6½c delivered, the cost per cubic yard for fuel amounted to only $0.00133, which is getting down toward the vanishing point.

With the successful conclusion of excavation work at Valley Springs, Mr. Kumle has moved the outfit to another placer operation which he is starting at La Grange. Though it has already moved more material than the average dragline of its size moves during its lifetime, the Bucyrus-Erie 34-B is considered, after overhauling, in plenty good shape to tackle another million yards of placer gravel.

Raleigh Calked Ship at Trinidad

ASPHALT, now used for electrical insulation, was just calking material for Sir Walter Raleigh's ships in 1617. Raleigh, sick and broken after an unsuccessful South American expedition, was on his way back to England and execution. He found the asphalt from the pitch lake at Trinidad good calking material for the seams of his ships.

The same asphalt lake has supplied the principal base for varnishes and compounds used in the world's electrical machines—and many miles of road surface. Some asphalt for electrical insulation now comes from mined gilsonite and some from oil refineries.

—Westinghouse.

HAYWARD BUCKETS
WON'T QUIT OR CAUSE TIME OUT
A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.
THE HAYWARD COMPANY
52-54 Church Street
New York, N. Y.

A TRAILER for Every Heavy Duty Requirement
THE LA CROSSE TU-WAY
● *Fully Reversible—Pulls from either end*
● *Brakes on all wheels controlled from either end*
● *Pneumatic Tires*
● *Meets all road width restrictions*
Trailers of all types and up to any capacity.
Write or Wire
C. R. Jahn Co., LaCrosse, Wis.

For your convenience in writing to the advertisers on this page, you will find a card bound in this issue.

Roebling...
The pacemaker in
wire rope development
JAR
THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co.,
Trenton New Jersey

For your convenience in writing to John A. Roebling's Sons Company, you will find a card bound in this issue.

Digging by "Stame"

(Continued from page 237)

with the true interests committed to him.

That it has been my honest purpose, throughout vigilantly to guard those interests, I am conscious is accorded. That I have done so and that, at the same time, I know—while in the satisfactory fulfilment of your contracts, there is abundant evidence of the ability on your part, to be useful, which must ensure you ample employment hereafter — you have lost neither in fame, nor fortune under me, is a satisfaction even greater than the approving voice, which so flatteringly has reached me, from those with whom I have now for years been associated, on the Boston and Providence Railroad.

To the steadfast support which I have received throughout the progress of that work, however, in the liberal and enlightened policy of its Direction, you will agree with me, that our united thanks are due.

In conclusion, allow me to bear my public testimony not only to the skill industry with which you are your associates have, one and all, executed your contracts, but also to the cheerfulness and perseverance which have distinguished your efforts, and with my best wishes for your future welfare and happiness, believe me

Your friend, and obedient servant,

Wm. Gibbs McNeill

Much rumour and too little certainty make tracing of the activities of the original Otis shovels remaining in this country a problem of eliminating reports which conflict with the available facts.

Canton Shovel on the Welland Canal?

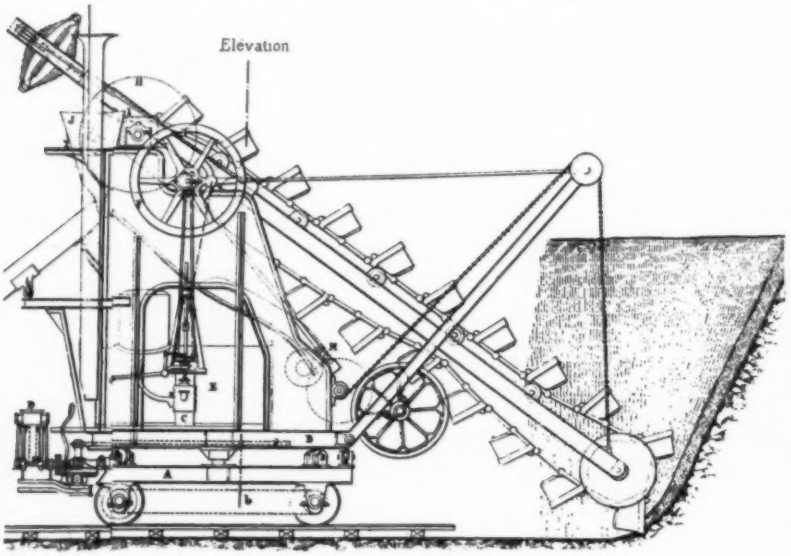
There is every evidence that shovels were used on the Welland Canal. There were four periods of its construction, the first occurring too early for power shovels to have been used.

The second period was about 1840 to 1850, and it is known that Carmichael and French had a contract at this time somewhere between Welland and Port Colborne, but as Carmichael then was using the only two shovels built in Philadelpia, still on this side of the Atlantic, upon the construction of the Atlantic Docks, if a shovel was used on the canal, it must have been the one built at Canton, Massachusetts. The following quotation from a letter substantiates the report that a shovel was used on the canal at this time.

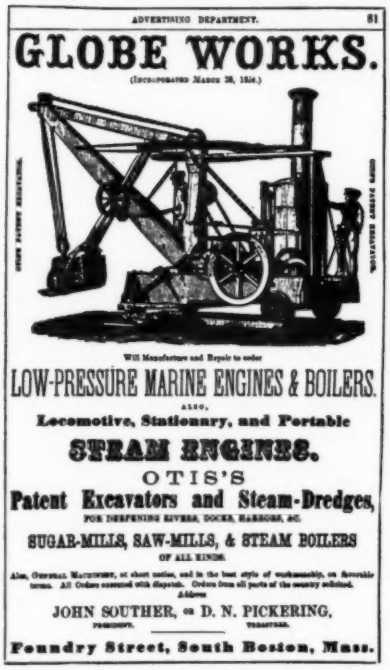
"Hosea T. Stock made the designs for a dredge in which was put the machinery of an Otis Steam Excavator owned by Charles H. French. The dredge was built at Allanbury, Ontario, 1843 is the date that sticks in my head (H.F.D.) the dredge laid idle for one year on account of threats from the Irish laborers whose mouths it would rob.

"After they were starved out and went away, the dredge started. When they came to run the canal at Port Colborne through a swamp, the exhausting pumps of the dredge were inadequate to keep the cut dry and so the dredge had to stop, so I have been told by both Father and Grandfather. Both told me they would write me what they knew of the first start but they never did it."

During the third period of construction of the Welland Canal, about 1870, several Osgood and

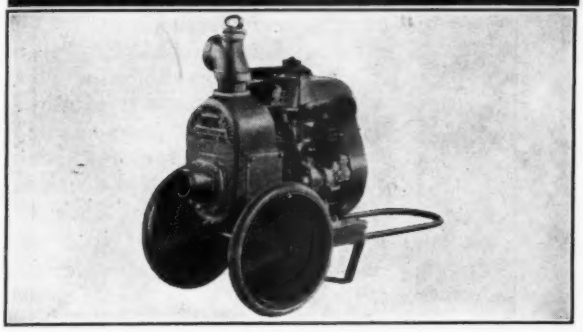


• *De Lesseps took this European type excavator to Panama to use on the canal. When he came to the United States in 1880, he ordered one each of the Otis-Chapman and Osgood shovels, which proved superior to the type illustrated here.*


ADVERTISING DEPARTMENT. 81
GLOBE WORKS.
(INCORPORATED MARCH 28, 1854.)
Will Manufacture and Repair to order
LOW-PRESSURE MARINE ENGINES & BOILERS.
ALSO,
Locomotive, Stationary, and Portable
STEAM ENGINES.
OTIS'S
Patent Excavators and Steam-Dredges,
FOR DEEPENING RIVERS, DOCKS, HARBORS, &C.
SUGAR-MILLS, SAW-MILLS, & STEAM BOILERS
OF ALL KINDS.
Also, CHURCH MACHINERY, at short notice, and in the best style of workmanship, on favorable terms. All Orders executed with dispatch. Orders from all parts of the country solicited.
Address
JOHN SOUTHER, or D. N. PICKERING,
PRESIDENT. TREASURER.
Foundry Street, South Boston, Mass.

• *In 1860 the Otis shovel was mentioned in a few advertisements but without illustration. The first picture of an Otis used in advertising is reproduced above. It appeared in 1862.*

ANNOUNCING A NEW SERIES OF
REX SPEED PRIME PUMPS
TO MEET YOUR 1936 NEEDS—



NEW REX 2″ and 3″ MODELS
7,000 and 15,000 G. P. H.
LOWER PRICE - - LIGHTER WEIGHT
POSITIVE RECIRCULATION CUT-OFF
Send Today for Bulletin No. 276
GET NEW 1936 PRICES
CHAIN BELT COMPANY
1652 W. Bruce St., Milwaukee, Wis.
REX *Construction Equipment*

Gatke
Genuine Moulded Brake and Friction Blocks for Every Service

For the biggest service and performance value in Brake or Friction Blocks, investigate GATKE GENUINE MOULDED.

It's kind to drums, has long life, provides velvet-smooth control, and is available in all shapes and sizes. Write for literature on

- ☐ Gatke Genuine Moulded Brake and Friction Blocks
- ☐ Gatke Heavy Duty Brake Lining
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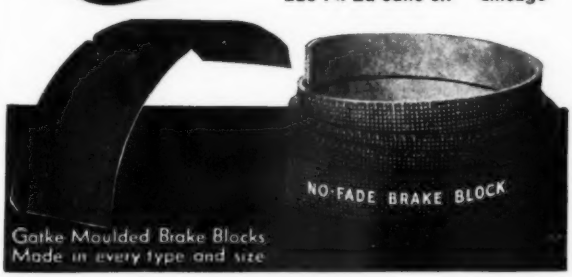
GATKE CORPORATION
228 N. La Salle St. Chicago



Gatke Moulded Brake Blocks
Made in every type and size

PROFIT? OR LOSS?
Shovel Drives often hold the ANSWER

This Bucyrus-Erie 75-B Electric Shovel is operated by Hill and Suender near Frackville, Pa. Powered by Westinghouse.

●A penalty job . . . dates to be met *on time* or contract clauses will start eating into profits. That's the kind of a job where it pays to own *Westinghouse-powered* shovels.

Westinghouse shovel equipment is not only geared for speedy digging, it is also built to withstand that pace—yard after yard, day after day.

From the improved power plant right down to the crowd motor on the boom, every item has been applied with an engineering background based on first-hand knowledge of operating conditions. *It is built to stand the gaff on tough jobs.*

●

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
EAST PITTSBURGH PENNSYLVANIA

OVERNIGHT SERVICE ANYWHERE

R 52017

Westinghouse
ELECTRIC SHOVEL DRIVES

Otis-Chapman dipper type dredges were used.

Also, there is first hand testimony that an original Otis shovel was used on the canal at this period. Phil Rouse, for many years an erector for Bucyrus-Erie Company, remembers working as water-boy on this shovel. He tells the story of its use on the canal.

"John Brown was contractor on several sections of the third step in construction of the Welland Canal, near Thorald, Ontario. He had four dredges working there, and brought this Otis shovel in from the states. It was the first steam land excavator ever used in that part of the country and was used to cut slope. The crew consisted of an operator, a craneman, a fireman, and about two men in the pit. The operator had the hardest job, working right next to the boiler where it was always hot. I carried water —two pails hanging on a yoke across my neck. I used to stop on my trips for water and watch the shovel work till the water got warm. Then my crew would get mad, dump the water out and I'd have to go get more. But even the cussing and extra work couldn't cure the intense fascination this new machine held for me. That shovel turned out good yardage at a considerable saving compared with hand labor and built a good grade, too. They worked it on wood rails. When they wanted to move, they'd lay a new section, then hitch a couple of horses to the shovel to help pull it along.

"They dumped into homemade, timber wagons that held two dippers and had three wagon-type wheels, two big ones with flat iron tires, and a smaller one in front. These carts were pulled by one horse and dumped by hand. An extra horse was sometimes used as a "helper" on the grades. The horses pulled the carts over to the slope, a rope was hitched cn, and they were pulled up the slope on a plank runway. From the top other horses pulled 'em over to the dump.

"Some of these wagons were fixed so they could dump either over the side or end. The body was revolving, so if they wanted

• *Phil Rouse was born in Thorald, Ontario. When the Otis shovel was brought in to work on the Welland Canal, he was so fascinated by it that he went to work as a water boy, at the age of 10 or 11, in order to be near it.*

to lengthen the fill, they'd just whirl the car around and "end-dump" it.

"Charley Coleman was the first operator on this shovel, and he broke in the second, "Dad" Wilson, his nephew. Jim Canan was superintendent.

"When section 15 was cleaned up, the shovel was loaded on a barge and moved to the "deep cut" between Allenberg and Port Robinson. Then later, it was brought back to Thorald and put to digging rock on section 16. Everybody thought John Brown was crazy—trying to dig rock with a steam shovel, as this was the first time, according to our organization, that one of these new "contraptions" had been used for heavy digging.

"About 10 or 12 feet of overburden had been stripped off by hand, leaving solid rock about 10 feet thick. They had one little steam drill, and blasted with black powder. I was only about 11, and I don't remember how they set off the charge. The shovel tied into the blasted rock and made excellent progress without any serious delays for repairs.

• *By 1864, when this ad appeared, the Globe Works had become John Souther and Co., and had moved to to a new location in South Boston. Also, a new picture of the shovel had been secured.*

"John Brown grinned all over every day when he came along on his inspection trip and watched the Otis piling the rock into the cars. When the work was completed, the shovel was sold to a contractor who dismantled it, put it on a sailing vessel and shipped it up to a Lake Superior port where he could move it overland to his contract on the Canadian Pacific. "Dad" Wilson went with the shovel, set it up and operated it for about a year. And that's the last I heard of it.

"Most of the pick-and-shovel men working on the Welland Canal were Swedish or Italian. Wages were ten cents an hour, for ten hours a day, six days a week. As a water boy I got fifty cents a day. The shovel operator got eighty-five or ninety dollars a month, and that was considered fine pay. Shacks were built along the canal for the laborers to live in, and they boarded themselves."

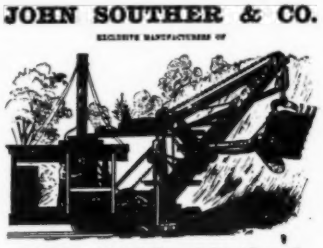
What About the Sioux River?

Statements that an original Otis shovel was used on the Sioux River may also come from such a confusion of names as occurred with the B. & O. and the B. & A. Railroads, for Sioux sounds much like salte. While no work of that period has been traced to the

1334 BOSTON DIRECTORY.

COVER YOUR BOILERS AND STEAM PIPES
WITH THE
ASBESTOS FELTING CO.'S
Fire Proof Non-Conductor,
The only SURE, DURABLE, ECONOMICAL, and POPULAR plastic covering known, for Boilers, Steam Pipes, Breechets, Elbows, Tanks, Hot Blast Pipes, Flues, Fire Proof Felting and Walls, Ice Houses, &c. Now in use by over FIVE THOUSAND of the principal owners of Steam Power in the United States. Send for circular containing
H. W. SAYRE, Supt., 11 PEMBERTON SQUARE, BOSTON.
BEWARE OF SPURIOUS IMITATIONS.

JOHN SOUTHER & CO.
EXCLUSIVE MANUFACTURERS OF



Otis' Patent, with O. S. Chapman's Patent Improved
Steam Excavators and Dredges,
With O. S. CHAPMAN'S recent Improvements attached.
SUGAR MILL MACHINERY,
STATIONARY AND PORT ENGINES AND GENERAL MACHINERY.
Corner A and Richards Streets,
P. O. Box 3133. South Boston.

KOEHRING

SPEED-S

KOEHRING DUMPTORS

—used by leading contractors, for all types of grading and hauling jobs. Proven performance, economical upkeep, increased production and low cost hauling — all outstanding features of this modern dirt-moving unit. Repeat orders to increase original fleets give definite proof of contractor acceptance.

High speed travel, fast and convenient loading and instantaneous dumping, combine to make the Koehring Dumptor a profit-earning tool. Write us for information regarding the profitable application of Koehring dirt-moving equipment to your job.

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

For your convenience in writing to Koehring Company, you will find a card bound in this issue.

Sioux, dredging was done on the Saulte Ste. Marie in 1854 and the description says that a dredge built by Osgood and based on the Carmichael-Osgood patents of 1846 (referred to later) was used. This was essentially an Otis shovel mounted on a dredge, and the confusion through calling it an Otis shovel could easily occur. Incidentally, while there is a Big Sioux River and a Little Sioux River, there is no Sioux River.

Russia Imports U. S. Machines and Engineers even in 1842

Russia was the largest customer for the original Otis shovel. Four shovels were shipped to Russia and one to England, and two only remained in the United States. This statement refers only to the perfected shovels built in Philadelphia, and does not include the first or experimental one built at Canton, Massachusetts.

It is not pertinent to the history of the shovel to describe in detail the part played by the engineers and artisans of the United States in building the railroad from St. Petersburg to Moscow. A certain Chevalier de Gerstner was sent to the United States in 1839 to investigate our methods of railroad construction. He reported that one of the causes of cheap construction here was the "use of labor saving machinery, particularly the steam excavating machine used in constructing the railroad between Worcester and Springfield." On Gerstner's recommendation, Major George W. Whistler, who was then chief engineer of the Western Railroad where the shovels were being used, was selected as consulting engineer for the Russian road.

The following is an account by a visitor to the plant of Eastwick and Harrison in Philadelphia in September 1843:

"The Otis excavators are to be used extensively on the St. Petersburg and Moscow Railway in Russia. One machine was sent out last year (1842) and three more have just been completed and are now ready for shipment. Messrs. Fairbanks and Carmichael, the owners of the equipment, have, we understand, taken a contract for the excavation of 25,000,000 cubic yards on this road."

Many other orders for machinery and machine tools for Russia were placed in Philadelphia at that time, to such an extent that one authority said: "but for the Russian orders many of our industrious mechanics would now be out of work."

Further details of Russian activity are given in the biographical sketches of Gerstner, Whistler and Harrison.

France Gets a Glimpse of an Otis

The first of the four Otis shovels sent to Russia was shipped in 1842. This shovel was unloaded when the ship reached France and a demonstration given in Paris as the following statement, taken from a Paris journal of 1843 shows:

"A trial of an immense machine for cutting railroads named by the inventor, a native of the United States, "The Railway Excavator," was made yesterday in the premises of Messrs. Varvole and Company, the engine and engine makers in the Avenue Trudaine. A large heap of earth and stone was placed at one extremity of the yard and the machine having been set to work by means of an engine of 20 h.p. forming part of it, the greater part was cut through and the rubbish thrown aside in a few minutes. One of these machines is, we understand, now in use in the Eastern Counties Railroad."

LIST OF SEPARATE PARTS

OF THE

OTIS EXCAVATOR

— FROM —

JOHN SOUTHER & CO.,

12 POST OFFICE SQUARE. - - - - BOSTON, MASS.

That duplicates may be ordered understandingly, and to facilitate our filling your orders, we furnish this list of the important parts of our Excavators enumerating the pieces in the order in which they are used on the shafts, commencing at the right.

2 Swinging plank shafts.
2 Swinging plank spindles.
2 Boxes, 1⅞ inch holes.
2 Boxes, 1⅞ inch holes.
2 Swinging plank pulleys, 1⅞ inch holes.
2 Swinging plank pulleys, 1⅞ inch holes.
1 Saddle casting on swinging plank.

1 Knock out shaft.
1 Knock out gear with pin.
2 Boxes for shaft.

1 Segment gear shaft.
1 Segment gear.
2 Boxes for shaft.
1 Finger gear and pin, works into segment gear.
1 Intermediate knock out gear and pin, works into large knock out gear.
1 Pawl casting, that pawls are pinned to.

One Post.

1 Swivel.
1 Chafing iron. (centre of post back.)
1 Kick out casting below chafing iron.

1 Shoe for deck casting, that crane braces set in.
1 Deck casting.
1 Step, bottom of post.

2 Angle irons at end of coffin plank.
2 Jack nuts for angle irons.
2 Jack screws for coffin plank.
2 Castings for diagonal bolts under coffin plank.
2 Jack plank castings running from deck plank to coffin plank.

2 Flange jack nuts for back screw planks.
2 Jack screws.

1 Forward axle.
2 Wheels for forward axle.
2 Boxes for forward axle.

1 Hind axle.
2 Wheels for hind axle.
1 Large move up pulley for hind axle.
2 Boxes for hind axle.

Chains.

1 Endless chain for crane.
1 Moving-up chain.
1 Hoisting chain.
Arm and swinging chain.

☞ We have had experience with the different kinds of chain iron, and the iron we have used for a number of years makes probably the most durable chain in the market. We furnish all sizes.
The Excavator chains are made with especial care.

• *Two pages of an early catalog of John Souther and Co. The date of this catalog is uncertain, but the picture is the same as that on the advertisement which appeared in 1864, which would seem to link them together. The addresses on the two, however, are different.*

Although only one of the original seven Otis shovels went to England, there are fairly complete records of its reception and early use there. These, and subsequent English developments, will be in the next installment of Mr. Farrell's history.

Other features of the story will be another first-hand account of operations with an early Otis shovel, and a portrait of the inventor, William S. Otis.

Don't miss your copy of the June Excavating Engineer!

Do You Remember?

CAN ANY old timer tell us anything about the Otis-type steam shovel pictured on the frontispiece of the April Excavating Engineer? We'd like to know who owned it, where it worked, and any interesting stories you might know, or have heard, about it.

Visitor: "Do you write all the jokes used in this magazine?"

Editor: "Yes."

Visitor: "Well, if I may compliment you, you must be much older than you look."

Book Reviews

Norman W. Henley Publishing Co., New York City, has recently published **Elements of Diesel Engineering** by Orville Adams. Stationary, Marine, Automotive and Locomotive Engines are discussed in the 478-page, illustrated book, which may be used equally well for study and reference, or a manual on operation and repair. The book is priced at $4.00.

Mine Plant Design is the title of a new reference book by W. W. Staley, assistant professor of mining, University of Idaho. Some chapter headings of the book are: "Graphical solution of simple beams and trusses; roof trusses; columns and footings; headframes; mine hoists; compressed air; mine ventilation." Emphasis is placed throughout on solution of practical problems. The book may be obtained from the McGraw-Hill Book Co., New York City.

A new illustrated bulletin, recently issued, describes new lines of **clamshell dredging buckets** of the Williams power-arm type. Buckets described range in size from ½ to 3 cubic yards, and were developed to meet severe under water, and difficult land excavating conditions. Copies may be secured by writing the Wellman Engineering Co., Cleveland, Ohio.

Two stage, air-cooled portable compressors are covered in a new 32-page catalog issued by Ingersoll Rand Company. In addition to giving complete construction details, the catalog is illustrated with views showing the compressors at work on road and contract jobs throughout the country. Copies may be obtained by writing Ingersoll-Rand Company, 11 Broadway, New York City.

A 12-page booklet on **road finish spreaders** was recently issued by Blaw-Knox Company, Pittsburgh, Pa. Characteristics of the spreader are given, specifications listed. A series of illustrations shows the spreader in operation, and samples of its work. Copies of the booklet may be obtained by writing to the manufacturer.

Welding Cast Iron—A well illustrated 8-page booklet has just been released by **The Linde Air Products Company**, 30 East 42nd Street, New York. It is a consolidation and orderly arrangement of the known facts regarding the repair of damaged cast iron machinery by the oxy-acetylene process. The booklet discusses the applications for which the respective processes of bronze-welding and fusion welding are best suited. Neither shape nor size, according to the booklet, places any limitation on the use of the oxy-acetylene process for the repair of gray iron, malleable iron, or alloy castings. Bronze-welding, because it is done at a lower temperature, is said as a rule to be more economical and efficient than the fusion welding of cast iron. Special cases where this rule does not apply and where fusion welding is preferred are mentioned. Those whose activities involve the use or repair of cast iron machinery will find it well worth their while to obtain a copy of this booklet which will be sent free of charge on request.

Trade Notes

Hercules Powder Company has announced that it moved its New York offices on April 11 to 22 East 40th Street at Madison Ave., New York City. Friends of the company are invited to view the displays of Hercules products at the new quarters.

The Lincoln Electric Company, Cleveland, Ohio, announces the moving of its Pittsburgh office, formerly at 323 Fourth Ave., to larger quarters at 926 Manchester Blvd.

The new location contains 1000 feet of floor space for storing and displaying arc welders, electrodes and supplies and, because of its ready access from all parts of the city, will afford prompt service to all users of arc welding in the Pittsburgh district.

Van Auken-Ragland, Inc., advertising agency, has announced its moving to new and larger quarters in the Twenty North Wacker Building, Chicago, Ill.

Meeting Place of Capital and Labor

THE KOENIG LABOR AGENCIES

Established 1875

ST. LOUIS
612 Walnut St., Main 2766 and 2767
KANSAS CITY
501 Delaware St., Main 0796
HELP OF ALL KINDS FURNISHED FREE

POSITIONS WANTED

Positions wanted advertisements will be run under this heading for 5 cents per word, minimum charge $1.00. Advertisements for help wanted free of charge.

Address all box numbers c/o Excavating Engineer at South Milwaukee, Wisconsin

SHOVEL-DRAGLINE-CRANE OPERATOR
Experienced operator desires position on any type or size machine, preferably large electric. Has operated steam machines—7 years; electric—3 years; gasoline—3 years; Diesel—3 years. Machines operated include shovel (9 years), dragline (3 years), clamshell (1 year) and crane (3 years) on highway work, railroad construction and stripping. Can do own repair work. Age 36; single. Willing to go any place. Can furnish references. Now located near Harrisburg, Pa. Box 8101.

STEAM SHOVEL OPERATOR
Twenty years' experience on steam shovels on contracting and railroad work qualifies me to operate your steam machine. Age 44; married. References. Now located Southern Idaho. Box 8102

EXPERIENCED OPERATOR
Operator having 19 years' experience on all types of machines, steam, gas, Diesel and Gas plus Air power desires position on shovel or dragline, steam, gas or Diesel, 1 to 6 yards capacity. Prefers Bucyrus machine. Has worked on railroad construction, highway, lock and dam building jobs, willing to go anywhere. Age 45; married. Can do own repair work. Best of references. Now located near Danville, Illinois. Box 8103

SHOVEL-DRAGLINE OPERATOR
Experienced shovel and dragline operator, 10 years on gasoline and Diesel machines on highway, railroad, mining, power dam and river work desires position on railroad or dam construction operating gas or Diesel machine any size. Can operate dredge. Willing to go anywhere. Age 34; married. Can do own repair work. A-1 references. At present located Upper Michigan. Box 8104.

STEAM SHOVEL OPERATOR
Have 25 years' experience on steam machines on all kinds of construction work. Desire position on any make, size or type steam shovel; anywhere. Can do own repair work. Best references furnished. Age 50. Married. At present located in Missouri. Write Box 8105.

DRAGLINE OPERATOR
Operator having 20 years' experience—eight years on shovel, ten years on dragline and two on clamshell—desires work on dragline, preferably gas or electric. Experience includes work on levee building, railroad construction, drainage ditches and in quarry. Can do own repair work. Age 42; married. Willing to go anywhere for steady work. Best of references. Located Southern Ohio. Box 8003

DRAGLINE OPERATOR
Dragline operator who has 13 years' experience on levee and ditch work desires position on Bucyrus or Monighan, gas or Diesel power, any size. Operated Diesel machine 7 years; gas-6 years. Willing to go anywhere. Can do own repair work. References furnished. Age 44; married. Now located in Ohio. Box 7903.

EXPERIENCED OPERATOR
Dragline and Shovel operator having 9 years experience desires position operating machine on road building, sewer, canal or drainage excavation. Prefers 3 or 4 yard Diesel dragline, having 5 years experience on Diesel powered machines and 4 years on gas machines. Has operated dragline 5 years, shovel, 2 years, clamshell, 1 year, and crane, 1 year. Age 31; married. Can do own repair work. Best references. Willing to go anywhere. Now located in Illinois. Box 7902.

DIESEL OPERATOR
Sixteen years experience on shovels, draglines and clamshell-cranes—seven years on Diesel powered machines—on drainage work and dam construction are my qualifications. Have also operated steam and gasoline powered excavators. Prefer position on Bucyrus or Monighan steam or Diesel dragline or crane; capacity 1 to 6 cubic yards. Willing to go any place. Can do own repair work. Age 33; married. Can furnish good references. At present located northwestern Ohio. Box 8005.

DRAGLINE OPERATOR
Operator experienced on levee, revetment and drainage work desires work on Bucyrus-Erie steamer, any size. Seventeen years on dragline, two on clamshell and one on crane. One year each on gasoline and Diesel machines. Can do own repair work. Will go anywhere in U. S. Age 36; married. A-1 references furnished. Located near Memphis. Box 8004.

SHOVEL OPERATOR
Operator—10 years' experience on shovel, dragline and clamshell—on general excavation and mining—desires work on any make and type machine. Can do own repair work. Will go anywhere. Age 40; single. Best of references. Present location near Chicago. Box 8001

DRAGLINE OPERATOR
Experienced crane and dragline operator wishes work preferably on Bucyrus dragline or piledriver. Has operated steam and gasoline machines for 15 years. Willing to go anywhere in U. S. Can do own repair work. Age 39; married. Good references. Located near Chicago. Box 8002

EXPERIENCED OPERATOR
Experienced shovel-dragline-crane - clamshell operator desires work anywhere, preferably in foreign country. Twenty years' experience includes work on gas, electric, Diesel and steam machines. Can do own repair work. Best of references. Present location West Virginia. Box 8006.

EXCAVATING ENGINEER Bargain Counter

★ ★ ★ THE ITEMS LISTED on these pages have been selected because they offer unusual values to the man who is looking for a bargain. Some of this equipment is surplus stock which has never been used, some is rebuilt and carries new equipment guarantee, some is just plain used. But every item is priced for quick sale. If any of this equipment fits your needs send a postcard or letter, mentioning the reference number. to *Bargain Counter, Excavating Engineer, South Milwaukee, Wisconsin.* We'll pass your inquiry along to the owner and you will receive price and complete information promptly. Act now — with advancing prices on new stock this equipment will move fast.

COMPLETE FRONT END EQUIPMENT

Shovel Equipment

½ CU. YD. DIPPER, 16' boom, 13'8" dipper handle. Shovel equipment suitable for type "A" shovel. NEW. SE-30.

⅝ CU. YD. DIPPER, 12'6" dipper handle, 16' boom. Shovel equipment suitable for type "A" shovel. NEW. SE-31.

¾ CU. YD. DIPPER—23' BOOM—12'6" DIPPER HANDLE—Shovel Equipment suitable for 20-B Gas or Diesel. NEW. SE-15.

¾ CU. YD. DIPPER 25'9" BOOM—14' DIPPER HANDLE—Shovel Equipment suitable for 30-B Diesel. NEW. SE-17.

¾ CU. YD. DIPPER—20'6" BOOM, 17' DIPPER HANDLE, high lift shovel equipment suitable for 20-B steam. NEW. SE-32.

⅞ CU. YD. DIPPER—21'9" BOOM and ENGINE — 15' DIPPER HANDLE — High Lift Shovel Equipment. Suitable for 31-B Steam. NEW. SE-18.

1 1 CU. YD. DIPPER—26' boom, 17' handle Shovel equipment—Will fit 30-B. SE-35.

1¼ CU. YD. DIPPER — 25' BOOM — 17' DIPPER HANDLE — Slightly Used Rope Crowd High Lift Shovel Equipment suitable for Model 37-B. New Machine Guarantee. SE-5.

1½ CU. YD. DIPPER—27' BOOM—17' DIPPER HANDLE—High Lift Rope Crowd Shovel Equipment suitable only for Bucyrus-Erie 43-B machines. Rebuilt—New Machine Guarantee. SE-23.

1 1¾ CU. YD. DIPPER, 30' boom. 19' handle. high lift steam shovel equipment—Will fit 50-B. New. SE-33.

1 1¾ CU. YD. DIPPER, 22' boom, 16' handle, shovel equipment—Will fit 43-B. New. SE-34.

Skimmer Scoop

¾ CU. YD. DIPPER—20' Boom together with all necessary ropes and material to completely convert Bucyrus-Erie 1020 Shovel, Clamshell or Dragline to Skimmer Scoop Machine. NEW. Shipment 2 to 3 weeks. SS-1.

Dragline Equipment

40' CHANNEL BOOM, FAIRLEAD AND ROPES, but not including bucket. For use on Model D-2—20-B—31-B. Used. DL-3.

BRAND NEW Ropes included with each of above Complete Equipments.

Trench Digging Equipment

1 CU. YD. 42½" WIDE—Solid type Dipper—24' Boom and all auxiliary equipment. Will dig maximum depth 22'. For application to GA-2 or GA-3 Shovel. Rebuilt—New Machine Guarantee. DS-5.

BRAND NEW PAGE, two dippers each ¾ cu. yd., one 38" wide over cutters, the other 49½" wide over cutters. 17'1½" Boom and all necessary auxiliary equipment. Will fit Bucyrus-Erie 1030 or 1035. DS-7.

1-CU. YD. 42½" WIDE SOLID TYPE DIPPER —24' Boom and all auxiliary equipment—will dig maximum depth of 22'—For application to GA-2 or GA-3 Clam Shell or Drag Line. Rebuilt —New Machine Guarantee. DS-8.

BRAND NEW Ropes included with each of above Trench Digging Equipments.

DIPPER HANDLES

1 7'6" 1030 TUNNEL—Complete. New. H-1.
1 7'10½" 20-B TUNNEL (two sticks). New. H-2.
1 9'0" 31-B TUNNEL (two sticks). New. H-3.
3 9'0" 30-B TUNNEL (two sticks each). New. H-4.
1 9'6" 20-B TUNNEL (two sticks). New. H-5.
1 9'6" 31-B TUNNEL (two sticks). New. H-6.
1 12 0" 18-B—Complete. New. H-7.
1 12'6" D-2, 31-B—Complete. New. H-8.
1 12'6" D-2, 31-B—Complete. New. H-9.
1 13'0" 1020—Complete. New. H-10.
3 15'0" E-2 41-B—Complete. New. H-13.
1 15'0" 43-B—Complete. New. H-15.
1 16'0" TYPE "A"—Complete. New. H-16.
2 16'0"—43-B—Complete. New. H-17.
1 17'0"—TYPE "A"—Complete. New. H-18.
1 17'0"—20-B HIGH LIFT—Complete. New. H-19.
1 17'0"—37-B—Complete. Used. H-21.
1 17'0"—50-B OIL (two sticks). New. H-23.
1 19'6"—37-B—Complete. New. H-25.

BOOMS

1—15'0" 1030 CHAIN CROWD SHOVEL BOOM—Used. JA-32
4—18' 20-B STEAM SHOVEL BOOM—New. JA-2.
1—18' 31-B STEAM SHOVEL BOOM—New. JA-3.
1—20'0" 1020 ROPE CROWD SHOVEL BOOM—New. JA-23.
1—20'0" 1020 ROPE CROWD SHOVEL BOOM—New. JA-33.
1—20'0" 1030 CHAIN CROWD SHOVEL BOOM—New. JA-24.
3—20'6" 20-B STEAM SHOVEL BOOM—New. JA-4.
1—21'6" 37-B CHAIN CROWD SHOVEL BOOM—New. JA-26.
1—21'9" 31-B STEAM SHOVEL BOOM—New. JA-5.
2—22'0" 43-B CHAIN CROWD SHOVEL BOOM—Used. JA-27.
3—23' 20-B DIESEL, GAS OR ELECTRIC SHOVEL BOOM—New. JA-7.
1—23'6" 37-B ROPE CROWD SHOVEL BOOM—New. JA-28.
1—24'0" 43-B ROPE CROWD SHOVEL Boom—New. JA-29.
1—24'0" GA-2 DRAG SHOVEL BOOM—New. JA-30.
1—24'0" GA-2 DRAG SHOVEL BOOM—Used. JA-34.
1—24'0" GA-3 DRAG SHOVEL BOOM—New. JA-35.
1—24' GA-2 or GA-3 SHOVEL BOOM—New. JA-8.
2—24' 43-B ROPE CROWD SHOVEL BOOM—New. JA-9.
1—25'0" 37-B ROPE CROWD SHOVEL BOOM—Used. JA-36.
1—25'9" 30-B DIESEL SHOVEL BOOM—New. JA-10.
1—26' 20-B DIESEL SHOVEL BOOM—New. JA-11.
2—26' D-2 SHOVEL BOOM—New. JA-13.
1—26' 50-B STEAM SHOVEL BOOM—New. JA-15.
3—27' 43-B ROPE CROWD SHOVEL BOOM—New. JA-16.
1—27'0" 43-B ROPE CROWD SHOVEL BOOM—New. JA-31.
1—30' 50-B ELECTRIC SHOVEL BOOM—New. JA-17.
3—30' 50-B STEAM SHOVEL BOOM—New. JA-18.
1—40' 20-B, 31-B and D-2 DRAGLINE BOOM—Used. JA-20.

DIPPERS

Small Machines

3 ½ CU. YD.—Plate Front—Will fit 1020 Drag Shovel. New. D-45.

2 ⅝ CU. YD.—Plate Front—Will fit 20-B. New. D-12.

1 2/3 CU. YD.—Plate Front—Will fit 14-B. New. D-13.

1 ⅞ CU. YD.—Ins. Tooth—Will fit 1030. New. D-47.

1 1 CU. YD.—Plate Front—Will fit 20-B. New. D-42.

1 1 CU. YD.—Manganese—Will fit B-2 and GA-2. Good condition. Used. D-40.

1 1 CU. YD.—Rock Type—Will fit 1030 Tunnel Shovel. New. D-50.

2 1¼ CU. YD.—Ins. Tooth—Will fit 30-B, 41-B, 42-B, E-2. New. D-44.

1 1¼ CU. YD.—Cast Front—Will fit 30-B, 41-B, 42-B, E-2. Used. D-43.

1 1¼ CU. YD.—Rock Type—Will fit 30-B, 41-B, 42-B, E-2. Used. D-27.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. New. D-51.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. Used. D-52.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. Used. D-38.

1 1½ CU. YD.—Ins. Tooth—Will fit 42-B, 43-B. New. D-55.

1 1½ CU. YD.—Ins. Tooth—Will fit 43-B. Used. D-39.

3 1¾ CU. YD.—Ins. Tooth—Will fit 43-B. New. D-58.

1 ⅝ CU. YD. ROCK—Will fit 20-B. New. D-64.

1 1 CU. YD. PLATE FRONT—Will fit 30-B, 41-B, 42-B, E-2. New. D-65.

1 1 CU. YD. CAST FRONT—Will fit 30-B. New. D-66.

Large Machines

1 2 CU. YD.—Manganese—Will fit 43-B. New. D-62.

2 3 CU. YD.—2½" Molybdenum cast steel front, two part Van Port reversible teeth—Will fit 100-B, 68-C, 70-C. New. D-2.

1 3½ CU. YD.—2¾" nickel chrome steel front, two part Van Port reversible teeth—Will fit 68-C, 95-C, Class 80 Atlantic. New. D-3.

1 4 CU. YD.—2¾" Molybdenum cast steel front, two part reversible teeth. In good condition.—Will fit 100-C, 120-B. Used. D-4.

1 6 CU. YD.—Molybdenum steel front. Annealed cast steel back, two-part Reversible Van Port Teeth.—Will fit 200-B, 225-B and 320-B. New. D-11.

1 8 CU. YD.—Front Molybdenum steel, two part Van Port Reversible teeth. Slightly used but excellent condition.—Will fit 320-B. Used. D-6.

DIPPER TRIPS

1—30-B STEAM DIPPER TRIP—New. DT-1.

1—31-B STEAM DIPPER TRIP—New. DT-2.

7—50-B STEAM DIPPER TRIPS—New DT-4.

BUCKETS

Dragline

2 ¾ CU. YD.—BECO TYPE "X". 2200 lbs. New. DB-21.

3 2 CU. YD.—PAGE CLASS "C". 5630 lbs. New. DB-4.

1 2 CU. YD.—BECO TYPE "U". 3650 lbs. Rebuilt. DB-12.

1 2 CU. YD.—BECO TYPE "X". 5300 lbs. New. DB-23.

2 2 CU. YD.—BECO HEAVY DUTY. 5400 lbs. New. DB-24.

3 2⅛ CU. YD.—BECO TYPE "U". 3850 lbs. New. DB-13.

2 2½ CU. YD.—BECO TYPE "U". 4100 lbs. New. DB-14.

1 2½ CU. YD.—BECO HEAVY DUTY. 6500 lbs. Rebuilt. DB-9.

1 2½ CU. YD.—OMAHA—STD. 5400 lbs. Rebuilt. DB-10.

1 5 CU. YD.—BECO HEAVY DUTY. 12700 lbs. New. DB-28.

1 5 CU. YD.—MONIGHAN HEAVY DUTY. 12000 lbs. New. DB-16.

1 6 CU. YD.—MONIGHAN TYPE "W". 12500 lbs. New. DB-17.

1 7 CU. YD.—MONIGHAN TYPE "W". 1370 lbs. New DB-18.

Clamshell

1 2 CU. YD. TYPE PF WILLIAMS CLAM-SHELL BUCKET without teeth and counter-weight. CSB-1.

ELECTRICAL EQUIPMENT

90 H.P. MOTOR — GENERAL ELECTRIC — 3 phase, 25 cycle, 550 volt, 1500 RPM. NEW. EE-1.

5 KVA TRANSFORMER—GENERAL ELECTRIC—2200-3810 volt primary, 440-220 volt secondary—3 phase, 60 cycle, with cast iron tank and cover, including specially fastened bushings to prevent oil leakage. NEW. EE-4.

125 KW GENERATOR—WESTINGHOUSE—250 volts, 500 amperes, Direct current. 440 RPM. Includes two outboard bearings. NEW. EE-5.

TANKS

Water

5—260 GALLON 41⅞"x21"x6'4". No. 14 BW gauge steel plate. T-1.

2—200 GALLON 36½"x20⅛"x6'3" high. Elliptical—¼" steel plates. T-2.

1—283 GALLON 54⅝"x17⅜"x6'4". ¼" Steel plates. T-3.

Oil

4—60 GALLON 11½"x18"x77" Elliptical Blue annealed copper alloy smooth plate. T-4.

6—25 GALLON 47¼" dia. 14" deep—12 Gauge Std. Blue annealed copper alloy steel. T-5.

1—294 GALLON 48"x21¼"x6'4". ¼" steel plates. T-6.

4—50 GALLON 60" dia. x 12" deep—No. 12 Gauge Std. blue annealed copper alley. T-7.

Gasoline

1—44 GALLON 18" dia. 43" high—No. 14 Gauge U. S. Std. welded construction. T-8.

6—55 GALLON 30"x18½"x23½" 16 Gauge—U.S.S. Terne metal. (1 copper brazed and 5 soldered) T-9.

Air

2—5 CU FT.—16" dia. x 48" high—225 lb. working pressure A.S.M.E. Std. Tested to 340 lb. cold water test. T-10.

1—14 CU. FT.—21½" dia. x 77" high—200 lb. working pressure. Will pass inspection in Massachusetts and any Canadian Province. T-12.

2 16 CU. FT—22⅝" dia. 77" high—200 lb. working pressure A.S.M.E. Std. T-13.

ENGINES

Designed especially for application to Excavating or similar Equipment. Can be used for stationary or semi-stationary service.

Diesel

2—140 H.P. NEW, NON-REVERSIBLE ATLAS DIESEL ENGINES—5 cylinder, 9" bore x 10½" stroke. 514 R.P.M., 4 cycle, vertical overhead valves, dust proof, oil tight crank case and forced lubrication. Includes auxiliary air starting equipment. DE-2.

Steam

1 12½"x16" link reversing type for Railroad Shovel. ME-1.

2 4½"x5" reversible—20.8 H.P. at 400 R.P.M. 100 lb. Pressure. ME-2.

1 4¾"x5" reversible—23.2 H.P. at 400 R.P.M. 100 lb. Pressure. ME-3.

1 5"x5" reversible—25.6 H.P. at 400 R.P.M. 100 lb. Pressure. ME-4.

BOILERS

NEW

Will Make That Old Shovel Work Like New.

Can also be used for Miscellaneous Service

Vertical Type

2 46½"x110"—32 H.P.—155 lb. Working Pressure. Special Wood Burning Fire Box. ASME Std. Will fit any B-2 or B-3. B-9.

Locomotive Type

2 44'x17'—75 H.P. 125 lb. Working Pressure. ASME Std. Will fit Model 68-C. B-13.

1 44"x18'—88 H.P.—125 lb. Working Pressure. ASME Std. Will fit Model 70-C. B-14.

1—70"x12'—136 H.P. 175 lb. Working Pressure. ASME and Mass. Std. Will fit 120-B. B-18.

AIR COMPRESSORS

1 BRAND NEW WORTHINGTON—METAL-WELD—2-cylinder 7"x6" Vertical 162 cu. ft. piston displacement, Air Compressor. Fitted with Laidlaw feather valves—Lugs on side for mounting on skids or channels—Shaft extended and equipped with semi-flexible coupling to take 2⅝" drive shaft—Force feed lubrication. Automatic control. Includes 1" High capacity centrifugal circulating pump—"V" belt driven—18"x41" Air Receiver, 100 pounds working pressure, A.S.M.E. Standard. Electric or gasoline power required approximately 30 H.P., approximately 1000 R.P.M.—Compressor Speed approximately 550 R.P.M.—Overall dimensions: Height 45"—length 37½"—width 28". AC-3.

2 11"x11"x12" STEAM DRIVEN LOCOMOTIVE TYPE, Westinghouse air compressors with fittings. NEW. AC-1.

1 11"x11"x12" STEAM DRIVEN LOCOMOTIVE TYPE, Westinghouse air compressors with fittings. Used. Make offer. AC-2.

FOR SALE

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SMALL SHOVELS
Under 2 Yards

ASSORTED DIPPER SIZES

TWO P&H TYPE 206, ¾ c.y. Gasoline Driven, Crawler Type, 38' Boom with 20' extension, good condition. Fair leads for one machine only. Price $3,000.00 cash each, F. O. B. job site.

One Insley, Type R, No. 128, Full Revolving, ½ c.y. excavator with dipper boom, dipper stick, and dipper; also 30' Boom with 9' extension for crane work. Gasoline Driven, Crawler Type, good condition. Price $2,800.00 cash, F. O. B. job site.

Immediate Delivery. Above equipment at Georgia State Prison site, Reidsville, Georgia. Address communications to **Struck Construction Company, Reidsville, Georgia.**

LINK-BELT-K42, 1½-yard gas shovel; **MARION-480** Electric 2-yard shovel located in Texas; **MARION-31**—1-yard steam shovel in Indiana; **MARION-36** 1-yard steam shovel in Michigan. Elwood Sales & Mfg. Co., Lafayette, Indiana.

⅜-YARD

BYERS BEARCAT JR.—⅜ CUBIC YARD GASOLINE SHOVEL. BUDA HIVELO ENGINE. Approximately one year old. Excellent condition. Favorable price. Located Minnesota. Box 791-SS.

BYERS-BEARCAT — Combination Shovel—Pull Shovel and Lifting Crane; Half swing. Gasoline power. Excellent condition. Located Detroit, Michigan. Box 690-SS.

INSLEY SKIMMER SCOOP—48" BUCKET. Bargain price. located vicinity Moretown, Vt. Box 792-SS.

INSLEY — TYPE C — GASOLINE SHOVEL. Engine recently rebored and reconditioned. Machine generally in good operating and mechanical condition. Equipped with Buda type KTU Diesel engine. Located Arkansas. Box 814-SS.

INSLEY ⅜ YARD GASOLINE COMBINATION SHOVEL AND BACK HOE. Half swing. Steel Cab. Good condition. Located Central Pennsylvania. Box 735-SS.

UNIVERSAL-UNIT ¾-swing combination ⅜ cu. yd. gasoline shovel and 30-foot boom dragline, including ⅜ cu. yd. dragline bucket. Working every day. Good condition. Located Grand Haven, Michigan. Box 769-SS.

UNIVERSAL—MODEL B—GASOLINE SHOVEL. Good operating condition. Located Indiana. Will deliver any point in state. Box 781-SS.

½-YARD

BROWNHOIST MODEL NO. 2 ½ cu. yd. rope crowd gasoline shovel or clamshell. Waukesha four cylinder engine in good operating condition. Bargain price. Located near Peoria, Illinois. Box 689-SS.

⅝-YARD

P&H MODEL 300 SHOVEL—18' Boom, 15' Dipper Handle, ⅝ cubic yard Dipper, manganese front. Powered with Waukesha B U 4½"x6¼" engine, power clutch control. First class operating condition. Located Massachusetts. Box 663-SS.

¾-YARD

BUCYRUS-ERIE TYPE B STEAM COMBINATION SHOVEL-CLAMSHELL AND STEAM HOE. Machine completely rebuilt 1929. Good operating condition. Located near Boston. Box 517-SS.

BUCYRUS-ERIE—TYPE B—Combination shovel and 40' boom crane. Boiler reflued and the machine in fair operating condition. Located Arkansas. Box 815-SS.

BUCYRUS-ERIE TYPE B HIGH LIFT STEAM SHOVEL. Caterpillar mounted. Good operating condition. Located New Haven, Connecticut. Box 776-SS.

BUCYRUS-ERIE TYPE B CATERPILLAR MOUNTED, HIGH LIFT STEAM SHOVEL. Good operating condition. Located Connecticut. Box 775-SS.

BUCYRUS-ERIE TYPE B STEAM SHOVEL, cat. mounted, equipped with 19'6" boom 16' dipper stick and ¾ yard dipper including 36' clamshell boom in good working order. Located near Hudson, Pennsylvania. Price $1000.00. Box 493-SS.

BUCYRUS-ERIE TYPE B STEAM SHOVEL, Cat mounted, 19'6" boom, 14' dipper handle, ¾ cubic yard dipper. also 36' clamshell boom and front drum and gearing. Located Kansas City, Missouri. Box 622-SS.

1—Type B Bucyrus-Erie Combination High Lift Shovel and 40' Clamshell Machine.
1—Type B Bucyrus-Erie High Lift Shovel.
2—Type B-2 Bucyrus-Erie High Lift Shovels.
All located western Connecticut. Operating condition. Entire lot very low price. Box 573-SS.

BUCYRUS-ERIE 20-B COMBINATION STEAM SHOVEL - CLAMSHELL - DRAGLINE. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SS.

BUCYRUS-ERIE TYPE B STANDARD ¾ YARD STEAM SHOVEL—Quarry type Dipper—Caterpillar mounted. Good operating condition. Located Georgia. Box 752-SS.

TYPE B BUCYRUS-ERIE HIGH LIFT STEAM SHOVEL. 21'3" Boom, 18'4" Dipper Handle, ¾ cubic yard inserted Tooth Dipper—Power Boom Hoist—Boiler Feed Pump—Caterpillar Mounted. Located Chicago. Box 699-SS.

KOEHRING MODEL 301 COMBINATION SHOVEL & 40' BOOM DRAGLINE, caterpillar mounted Gasoline Power. Good operating condition. Located Indiana. Box 764-SS.

MARION MODEL 21 ELECTRIC—M.G. SET ¾ YARD SHOVEL. Good condition. Located eastern Pennsylvania. Box 725-SS.

NORTHWEST MODEL 3 GASOLINE CABLE CROWD—FEATHER TOUCH CONTROL—SHOVEL. Good operating condition. Located northern Indiana. Box 798-SS.

OSGOOD MODEL 18 Steam—¾ yard shovel—Cat mounted. Just completely overhauled. Excellent condition. Located near Indianapolis, Ind. Box 522-SS.

P & H DRAGLINE MODEL 206. Good condition. ¾ cubic yard, 38-ft. boom, Waukesha motor. $3,000 cash. James F. Cole, R. No. 5, Findlay, Ohio.

⅞-YARD

BUCYRUS-ERIE HIGH LIFT STEAM SHOVEL. B-2—⅞ CUBIC YARD DIPPER. Favorable price. Located vicinity Boston. Box 793-SS.

MARION MODEL 21 — ⅞ CUBIC YARD STEAM SHOVEL. Caterpillar Mounted. Good working condition. Located Georgia. Box 758-SS.

1-YARD

BUCYRUS-ERIE LATE MODEL B-2 STEAM HIGH LIFT SHOVEL. 1 yard dipper—single shaft cat mounting. Good condition. Located near St. Louis. Box 518-SS.

BUCYRUS-ERIE GA-2 GAS-AIR COMBINATION ONE YARD SHOVEL AND 45' BOOM CLAMSHELL AND DRAGLINE not including Buckets Recently reconditioned. Located Indianapolis. Box 766-SS.

BUCYRUS-ERIE—GA-2 GAS-AIR SHOVEL. Extra High Lift. Caterpillar mounted. Good operating condition Waukesha 5¾"x8" four cylinder gasoline Engine. Air Starter. Located Chicago. Box 754-SS.

BUCYRUS-ERIE GA-2 Gas-Air High Lift Shovel. 24' Boom, 18'4" Dipper Handle, 1 cubic yard Dipper. Single shaft cat. Waukesha four cylinder gasoline engine. Excellent operating condition. Located Milwaukee. Box 645-SS.

BUCYRUS-ERIE B-2 HIGH LIFT STEAM SHOVEL. 19'9" Boom, 16' Dipper Handle, ⅞ cubic yard inserted tooth Dipper. Two speed propelling gear. Located Boston. Box 716-SS.

BUYRUS-ERIE B-2 EXTRA HIGH LIFT STEAM SHOVEL. 21'3" Boom, 16' Dipper Handle, ⅞ cubic yard inserted tooth Dipper. Single Shaft Cat. Located Boston. Box 717-SS.

BUCYRUS-ERIE B-2 HIGH LIFT STEAM SHOVEL. Good operating condition. Located Minnesota. Box 794-SS.

FOR SALE

Address all box numbers c/o Excavating Engineer at South Milwaukee, Wisconsin

BUCYRUS-ERIE 30-B STEAM SHOVEL. Located St. Louis, Missouri. Box 817-SS.

31-B BUCYRUS-ERIE STEAM SHOVEL. 1-yd. dipper. For sale at $2,000 cash. $500 will put this machine in first class working condition. Shop No. 4853. Located western Tennessee. Box 822-SS.

1¼-YARD

BUCYRUS-ERIE GA-2 Gas-Air Extra High Lift Shovel—24' Boom, 18'4" Dipper Handle, 1¼ cu. yd. Dipper, Single Shaft Cat. Electric Starter. Excellent condition. Located eastern Pennsylvania. 592-SS.

BUCYRUS-ERIE GA-2 HIGH LIFT SHOVEL—24' boom, 16' dipper handle, 1¼ cubic yard dipper, on single shaft cat. Electric starter, Waukesha 4-cylinder 6¼"x8" gasoline engine. Reported excellent condition. Located Virginia. Box 623-SS.

BUCYRUS-ERIE — DIESEL-AIR — COMBINATION SHOVEL AND DRAGLINE. 22'6" Boom—16' Dipper Handle—1¼ cubic yard Inserted Tooth Dipper. 45' Boom Complete Dragline Equipment without bucket. Engine—Atlas Diesel. Located Oklahoma. Good operating condition. Box 703-SS.

BUCYRUS-ERIE GAS-AIR TYPE GA-2 HIGH LIFT SHOVEL — 22'6" boom — 16' dipper handle—1¼ yard cast front inserted tooth dipper—single shaft caterpillar mounting—electric starter. Excellent condition. Field reconditioned. Waukesha 4-cylinder 6¼'x8" engine — New cylinder blocks and piston rings. Located near Scranton, Pennsylvania. Will demonstrate. Box 508-SS.

BUCYRUS-ERIE GAS+AIR—22' Boom, 16' Dipper Handle, 1¼ cubic yard Dipper, Waukesha 6¼"x8" four cylinder gasoline engine. Single Shaft Cat mounted. First class condition. Located eastern New York. Box 601-SS.

BUCYRUS-ERIE GA-2 REBUILT — HIGH LIFT SHOVEL. 22'6" boom, 16' dipper handle, 1¼ cu. yd. dipper, air starter, steel cab, Factory reconditioned. Available about June 1. Located Pennsylvania. Box 805-SS.

LIMA 101 GASOLINE SHOVEL with 1¼ yard bucket. Waukesha motor. In good operating condition. Located in Ohio. Box 808-SS.

LIMA MODEL 101—Combination 1¼ yard shovel and 40' plus 10' extension Dragline—powered with gasoline engine Model JK 6½" x7"—4 cylinder. Shovel equipment practically new. Located Colorado. Box 599-SS.

LINK-BELT MODEL K-42 1¼ YARD GASOLINE SHOVEL. Waukesha Model WL 6¼"x 8" 4-cylinder Engine—new blocks and pistons this year. Good working condition. Located Colorado. Box 738-SS.

LORAIN—75-A—One and one-quarter cubic yard Gasoline Shovel. Good condition. Located Chicago. Box 676-SS.

LORAIN MODEL 75—1¼ YD. SHOVEL. 21'0" boom, 14' dipper handle. Also 45' plus 15', total 60', dragline boom and equipment, and 1¼ cu. yd. Page "M" dragbucket. Engine—Waukesha WL 6-cylinder 6¼"x8" gasoline. Located—Denver, Colorado Box 806-SS.

THEW LORAIN MODEL 75 SHOVEL. 24' Boom, 18' dipper handle, 1¼ cubic yard dipper. Gasoline. Machine now operating. Located central New York State. Box 665-SS.

MARION TYPE 32 STEAMER. Shop No. 5676, 18' boom, 15' dipper handle, 1¼-cu. yd. dipper shipped May, 1926, good operating condition. Box 451-SS.

NORTHWEST MODEL 105 SHOVEL. Bargain Price. Located Texas. Box No. 566-SS.

BUCYRUS-ERIE GA-2 COMBINATION SHOVEL AND DRAGLINE. 22'6" Shovel Boom, 16' Dipper Handle, 1 cubic yard cast front inserted tooth Dipper. 50' Dragline Boom including Fair leads but not Bucket. Air Starter. Good condition. Located Newark. Box 718-SS.

BUCYRUS-ERIE GA-2 HIGH LIFT SHOVEL. 24' Boom—18'4" Dipper Handle, 1 cubic yard Inserted Tooth Dipper. Also includes Forward Drum and Gearing and mechanism for clamshell operation including 45' boom. Also 1 cubic yard Williams clamshell bucket. Waukesha WL Engine. Good operating condition. Located Chicago. Box 702-SS.

BUCYRUS-ERIE MODEL B-2 High Lift Steam Shovel. Caterpillar mounted. Very good working condition. Located South Carolina. Box 644-SS.

BUCYRUS-ERIE MODEL B-2 High Lift Steam Shovel. Caterpillar mounted. Good working condition. Located northern New Jersey. Price very reasonable. Box 643-SS.

BUCYRUS-ERIE GA-2—Gas-Air Combination High Lift Shovel and 50' Boom Dragline Equipment, mounted on Single Shaft Cat. Good operating condition. Located at Fort Smith, Ark. Box 537-SS.

B-2 EXTRA HIGH LIFT STEAM SHOVEL. 24' Boom—18'4" Dipper Handle—¾ yard Inserted Tooth Dipper—Boom Hoist—Caterpillar Mounted—Good operating condition. Located Chicago. Box 700-SS.

LORAIN—MODEL 60—One cubic yard Gasoline Shovel. Good condition. Located Chicago. Box 677-SS.

MARION 1 CUBIC YARD STEAM SHOVEL. Bargain Price. Box 777-SS.

MARION 1 YARD STEAM SHOVEL. Box 575-SS.

NORTHWEST MODEL 105 GASOLINE CATERPILLAR MOUNTED COMBINATION SHOVEL AND DRAGLINE INCLUDING BUCKET. Good operating Condition. Located near Chicago. Box 795-SS.

P & H MODEL 600—1 yd. Gasoline Shovel—including 40' boom dragline equipment without bucket. Waukesha Engine. Recently overhauled. Located in Alabama. Box 483-SS.

P&H MODEL 600—1¼ CUBIC YARD GASOLINE SHOVEL. Will be put in good operating condition. Located eastern Pennsylvania. Box 664-SS.

P&H—MODEL 600—Combination 1 yard shovel and 40' boom dragline including dragline bucket. Waukesha gasoline engine. Machine in fair operating condition. Located Georgia. Box 695-SS.

1½-YARD

BUCYRUS-ERIE 43-B GASOLINE CHAIN CROWD SHOVEL — 23' boom — 17' dipper handle—1½ cubic yard Vanderhoef dipper and teeth—electric starter—standard single shaft cat. Operated less than six months. Excellent appearance and condition. Will be demonstrated by owner. Located vicinity New York. No. 512-SS.

TWO LORAIN 75-B COMBINATION 1½ CUBIC YARD SHOVEL AND 50' BOOM DRAGLINES — without buckets. Gasoline power. Good working condition. Located eastern Pennsylvania. Box 721-SS.

LORAIN 75-B 1½ CUBIC YARD SHOVEL. Gasoline power. Good working condition. Located eastern Pennsylvania. Box 722-SS.

MARION MODEL 32 CATERPILLAR MOUNTED STEAM SHOVEL—1½ cu. yd. dipper. Also clamshell and dragline equipment available without bucket. Boiler recently re-flued. Machine in A-1 condition. Priced right for quick sale. Located near Chicago. Box 803-SS.

OSGOOD "VICTOR" 1½ CUBIC YARD SHOVEL AND 50' BOOM CLAMSHELL MACHINE. Gasoline Power. Good operating condition. Located Wisconsin. Box 760-SS.

P&H MODEL 700—1-½ CUBIC YARD GASOLINE SHOVEL. Waukesha 7-½"x8" 150 Horsepower Engine. Located New Mexico. Box 797-SS.

P & H MODEL 700—1½ CU. YD. GASOLINE SHOVEL. Engine: Waukesha 4-cyl. 7½"x8". Fair working condition. Located New Mexico. Bargain price. Box 789-SS.

1¾-YARD

BUCYRUS-ERIE—50-B—DIESEL SHOVEL. 28' Boom, Two 19' Dipper Handles. 1¼ Cubic Yard Rock Bucket and 1¾ Cubic Yard Dirt Bucket. 60' Boom Dragline Equipment without bucket included. Shovel only located Montana. Dragline equipment located Minnesota. Box 785-SS.

2-YARD

BUCYRUS-ERIE 50-B STEAM SHOVEL Equipped with air compressor and Moon Turbo lighting system. Boom 30'. Dipper handle 19'. Dipper 2 cu. yd. Coal Loading type. Minor repairs needed otherwise excellent condition. Located Eastern Ohio. Box 818-SS.

BUCYRUS-ERIE 50-B — STEAM SHOVEL. 26' boom. 17' dipper handle. 2 cu. yd. dipper. 1½ KW Moon Lighting Plant. Excellent condition. Located St. Louis, Missouri. Box 819-SS.

SMALL DRAGLINES
Under 2 Yards

⅜-YARD

TWO ⅜-YARD SARGENT SCOUT DRAGLINES. Powered with McCormick-Deering Model 200 4-cylinder 4¼x5 heavy duty gas engines. Cable speed 160 fpm, single line. Two traveling speeds. Capacity as crane from 8000 lbs. at 8 ft. radius to 2800 lbs. at 24 ft. radius. First class mechanical condition. Located Iowa and Minnesota. Box 772-SD.

UNIVERSAL-UNIT ¾ swing combination 30-foot boom gasoline dragline and ⅜ cu. yd. shovel. ⅜ cu. yd. dragline bucket. Working every day. Good condition. Located Grand Haven, Michigan. Box 769-SD.

¾-YARD

BUCYRUS-ERIE 20-B COMBINATION STEAM DRAGLINE - CLAMSHELL - SHOVEL. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SD.

FOR SALE

Address all box numbers c/o Excavating Engineer at South Milwaukee, Wisconsin

SMALL DRAGLINES
Under 2 Yards
continued

KOEHRING MODEL 301 COMBINATION 40' BOOM DRAGLINE & SHOVEL, caterpillar mounted. Gasoline Power. Good operating condition. Located Indiana. Box 764-SD.

1-YARD

BUCYRUS-ERIE GA-2 COMBINATION DRAGLINE AND SHOVEL. 50' Dragline Boom including Fairlead but not Bucket. 22'6" Shovel Boom, 16' Dipper Handle, 1 cubic yard cast front inserted tooth Dipper. Air Starter. Good condition. Located Newark. Box 718-SD.

BUCYRUS-ERIE GA-2 GAS-AIR COMBINATION 45' BOOM DRAGLINE AND CLAMSHELL AND ONE YARD SHOVEL. Buckets not included. Recently reconditioned. Located Indianapolis. Box 766-SD.

LINK-BELT 1 CUBIC YARD CAPACITY 50' BOOM DRAGLINE WITHOUT BUCKET. Gasoline power. Reported good operating condition. Located near Chicago. Box 724-SD.

P&H—MODEL 600—Combination 40' boom dragline and 1 yard shovel including dragline bucket. Waukesha gasoline engine. Machine in fair operating condition. Located Geor... Box 695-SD.

1¼-YARD

BUCYRUS-ERIE — DIESEL-AIR — COMBINATION DRAGLINE AND SHOVEL. 22'6" Boom—16' Dipper Handle—1¼ cubic yard Inserted Tooth Dipper. 45' Boom—Complete Dragline Equipment without bucket. Engine—Atlas Diesel. Located Oklahoma. Good operating condition. Box 703-SD.

1½-YARD

LINK-BELT MODEL K-44 45' BOOM PLUS TWO 10' AND ONE 5' EXTENSIONS—TOTAL 70' DRAGLINE WITHOUT BUCKET. Gasoline power. Includes 800 Watt Kohler Light Plant. Located near Chicago. Good operating condition. Box 723-SD.

If You Do Not Find What You Want Listed—Write Us
Excavating Engineer
South Milwaukee, Wisconsin

2 LORAIN 75-B COMBINATION DRAGLINES AND SHOVELS. 50' dragline booms without buckets. 1½ cubic yard shovel equipment. Gasoline power. Good working condition. Located eastern Pennsylvania. Box 721-SD.

TWO P&H 700 DRAGLINES. 1½ cu. yd. buckets on 50' booms. Gas and Diesel. Located Lower Rio Grande Valley, Texas. Box 618-SD.

1¾-YARD

BUCYRUS-ERIE — 43-B GASOLINE — COMBINATION DRAGLINE AND CLAMSHELL— 1¾ cubic yard Bucket capacity—no bucket. Good condition. Located Arizona. Box 704-SD.

SMALL CLAMSHELLS AND CRANES
Under 2 Yards

⅜-YARD

BAY CITY "PUP" CLAMSHELL MACHINE. Good operating condition. Box 514-SCC.

½-YARD

BYERS BEARCAT CLAMSHELL—Crane—30' boom. Will handle ½ cubic yard bucket. Located near Grand Rapids, Mich. Box 648-SCC.

GENERAL—GASOLINE—35' BOOM CLAMSHELL. Now operating near St. Joseph, Illinois. Box 782-SCC.

ORTON 24' BOOM—½ CUBIC YARD CLAMSHELL MACHINE. ½ cubic yard Owen Clamshell Bucket. Hercules 55 HP. Gasoline Engine. Factory rebuilt 1932. Good operating condition. Located Tennessee. Box 709-SCC.

¾-YARD

BUCYRUS-ERIE 20-B COMBINATION STEAM CLAMSHELL - DRAGLINE - SHOVEL. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SCC.

O & S MODEL "T" ¾ yard clamshell machine. 40' boom. Good working condition. Powered with Climax 5½"x7" gasoline engine. Located near St. Louis. Good working condition. Box 651-SCC.

1-YARD

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LOCOMOTIVES

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1 Crowding Engine
1 Five Yard Dipper

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10 Slips.
1 Anvil.
1 Forge
1 Carbide light.
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